THE MODEL ENGINEER

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The MODEL ENGINEER

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SMOKE RINGS

Our Cover Picture

● THE PICTURE selected this week is of a model by Mr. E. G. Hollebone, of Speldhurst, which was featured in the Loan Section of the recent "M.E." Exhibition. It is a beautifully executed scale model of the "Old Berkeley" coach. The exhibit was accompanied by a complete set of the accessories normally carried on one of these old road coaches, accurate down to the brushes and combs for keeping the horses in condition. So that readers may have a better view of the details, two other views are shown, one on this page and one overleaf.

Mr. Hollebone is to be congratulated upon the high standard of accuracy and finish of the coach details, but more especially upon his lifelike horses, an achievement which in my opinion only an artist could have carried out with such realism. The picture overleaf, reminiscent of the popular Christmas card illustrations, also revives for me nostalgic memories of a sunlit autumn morning at Hyde Park Corner, where once I saw this famous four-in-hand, resplendent in its fresh paint and coachmen's liveries, threading its way through the motor omnibuses and cars on the start of its traditional run.—P.D.

A Judging Query

● A READER, writing more particularly about the judging of model locomotives in competitions, states that in my review of the " M.E." Exhibition Locomotive Section, I make the point that such details as the shape and size of chimney and dome count for much in a keen competition ; but he wants to know how this would affect a model built exactly to drawings *for that model*, without reference to the prototype, since, in such a case, the draughtsman may have made the shape and size of the chimney and dome incorrect.

The answer to this is that it all depends upon the information given by the competitor. If he states definitely that his model is based on any particular prototype, then any fault in the detail dimensions is due either to the competitor's own lack of observation or to his introducing erroneous modifications of his own, and the judges take due note of it. But if the model has been built from some published drawings, then the competitor is not penalised for perpetrating any errors which may be found in those drawings ; he would, however, gain marks if he took it upon himself to correct, in his model, any errors which he found in the drawings.—J.N.M.

Blue Kings

● AT THE moment of writing, the British Railways are running a number of locomotives painted in various styles, with the object of coming, ultimately, to a definite decision as to what shall be the future liveries of British locomotives. The effects produced, so far, cannot be said to be displeasing, though I, for one, may take some time to become fully accustomed to whatever changes are made. I live in territory served by the Western Region of British Railways ; that is, the former Great Western Railway. My recent vacation gave me ample opportunity to see much traffic which is not usually seen during my normal journeying to and from my office, and the first excitement came on the first Monday of the first week, when the ever-popular Cornish Riviera express came into sight with engine No. 6009, *King Charles II*, painted a darkish blue and tastefully lined-out in grey, yellow and red. The effect was very resplendent and decidedly novel, even though, personally, I prefer the old G.W.R. livery. On the same day, the " up " C.R.E. was hauled by No. 6026, *King John*, painted in the same style as No. 6009, and these two engines worked this turn regularly during that week and the next.—J.N.M.

An Unconventional Pressure-gauge

● I HAVE had a letter from an Australian reader who thinks that other " M.E." readers may be interested to know that English traction and portable engines, many of which date back to mid-Victorian days, abound in Australia. My correspondent found one ancient portable engine still pumping water from the Darling river ; and he seems to have had an illuminating chat with the owner of it, for he writes :—" When I asked what pressure the inspector allowed and when it was last tested, he replied that he did not know, as he had bought the engine only 13 years ago. I asked if the ancient-looking pressure-gauge was reliable, and learned that, although the gauge does register, the owner relied mostly upon the boiler shell as a guide to the pressure ; when he could see the shell ' breathing ' in time with the piston stroke, he reckoned he had sufficient pressure. The nameplate was mostly indecipherable, but the word ' Gainsborough' remained clear. I would have got further information, but at this stage of my inspection, I noticed that the boiler shell was ' panting,' and took my departure " !

I have a kind of notion that these old engines must have been very well built.—J.N.M.

News from Buxton

● I HAVE lately received a copy of *The Con Rod*, which is a bright magazine circulating among the members of the Buxton Model Engineering Society. From it, I learn that Mr. G. S. Wainwright has resigned from the editorship and that he has been succeeded by Mr. R. Hattersley who, I hope, will be able to carry on the good work of producing the society's magazine.

Naturally, the contents are almost entirely of local interest, since they deal chiefly with the activities of the society's members ; but I am glad to note that the model railway and locomotive side of our hobby is well to the fore. Some of the members are working together in producing a " society's locomotive " ; it is an *ex*-L.M.S. "Royal Scot," but the size of it is not stated. I fancy it must be a fairly large one, because the latest news of it is that progress is somewhat slow.

—J.N.M.

HISTORY REPEATS ITSELF

The story of the building of the 7¼-in. gauge L.M.S.R. "Duchess of Buccleuch" by H. C. Powell, who won the Locomotive Championship Cup in 1936 and repeated the feat in 1948

ONCE more history repeats itself. By Providence, hard work, and a "Duchess," I have again won the Locomotive Championship Cup. In 1936 with a "Princess Royal" 3½-in. gauge and now in 1948 with a "Duchess" 7¼-in. gauge.

made in the locomotive works at Crewe, but is, in effect, a product of my own garden workshop. True, I did not make the patterns; I designed them all, 146 of them, and they were made by my friend Mr. Simpson, who is a professional pattern-maker.

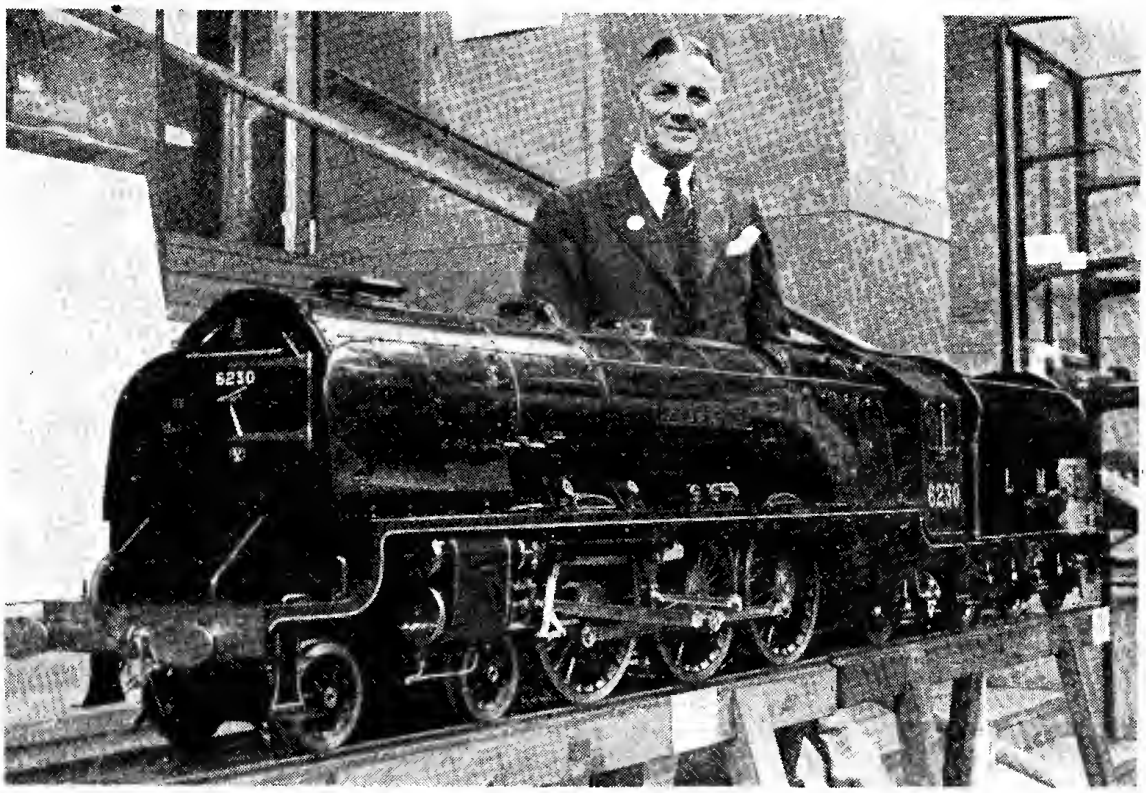


Photo by] [*British Railways*

Mr. H. C. Powell with his Cup-winning 7¼-in. gauge L.M.S. "Duchess of Buccleuch"

It is, I hope, a popular win, and I say right here that my nearest competitor was Mr. Cottam's "King," a truly remarkable piece of craftsmanship, with its attention to detail, and I wish that gentleman the best of luck in his future attempts.

I am not going to say "alone I did it"; as most readers are aware, a man cannot produce a locomotive of such magnitude unaided, as the total weight is 8 cwts. approximately, 6½ for the engine and 1½ for the tender. In the following notes, I will try to answer a few of the main questions asked, and a few remarks I heard which, of necessity, require answering.

Please, dear reader, believe me when I say that this locomotive, or any part of it, was not

The castings, which were of a very good standard, were made by Stuart Turner Ltd. and a local foundry.

The only other items not made in my workshop were two injectors and a pressure-gauge, by Bassett-Lowke Ltd.; last, but not least, was the finish on the paint work, which drew forth the admiration of all the visitors to the exhibition. The colour and black above the platform were cellulose-sprayed by S.B.N. (Car Spraying) Ltd., Droylesden, Manchester, and a beautiful job of work, indeed. The letters, numbers, and lining were done by P. J. Moss, of Crewe, again an excellent job of work. I am most grateful for the efforts of all concerned; and let me acknowledge

here, the help given me by my friends Mr. Mills, Mr. Simpson, and my brother Norman, who have assisted in some way, to bring the "Duchess" to a successful issue.

So much for the work I have not done; so to business, to give a brief idea of the building of this locomotive, which took about five years.

Drawings

I commenced by asking the L.M.S. Rly. Co. to provide me with six leading drawings, which they were pleased to do; so I started by looking them over at my leisure for about a month, deciding where the snags were for a model form of the locomotive, and with these in mind, I started to draw the main frames which are $\frac{3}{16}$ in. thick. I adhered to the outline strictly, and adjusted the sizes for rivet and bolt holes to the nearest standard sizes, using Whitworth pitches. These were jig-drilled and filed to shape, to be followed by the trailing frames which were partly cut on a milling-machine and the rest by hand.

Stretchers for frames were then designed and drawings for the patterns prepared, and introducing a water feed pump $\frac{7}{8}$ in. $\times$ $\frac{7}{8}$ in. stroke, actuated from an eccentric fitted to the crank on the leading wheel.

The 4-wheel bogie is of quite normal type with equalisers on top of axleboxes, sprung to bolster with spiral springs; it is provided with centralising springs, and has a lateral play of $1\frac{1}{8}$ in.

The pony-truck is built up from $\frac{1}{8}$-in. plate, box type, with cast pivot arm; the weight is taken up on cast supports and bearing on the main frame trailing stretchers, having centralising springs with a lateral play of 1 in.

Next we come to the cylinders which are four in number, 2 in. bore and $3\frac{1}{2}$ in. stroke; the originals are, of course, piston-valve, but were re-designed in model form to use slide-valves as they would be more readily accessible if I had any trouble, having in mind the old story that piston-valves wear out and slide-valves wear in.

This design was carried out without impairing the appearance of the outside cylinders, and, in fact, only four visitors realised that they were not piston-valves.

Cylinders are made of cast-iron; piston-rods and valve spindles are stainless steel, while the piston heads are cast-iron, each fitted with two rings. Cylinder-cock gear is fitted and is actuated from the cab, being situated on left-hand side.

Steam-sanding is also fitted, sand-boxes on inside of frame, each with a sand trap at the base, with filler pipes on top, while sand-pipes to rail are fitted with sand ejector and work very well on air. These ejectors were actually tested on air, using fine salt.

Wheels are of cast-iron, fitted to hollow axles; the crank is built up and brazed, and each return-crank is fitted with a ball-race as in the prototype, with keyway and spigot, so all weight is taken off the four studs which hold it in position. Driving axleboxes are in gunmetal with white-metal bearing top and with under bearing keep with pad for lubrication. Motion and valve-gear were jig-drilled and milled to finish-size and finished with Swiss files and fine emery to polish.

The Boiler

The boiler is of $\frac{5}{16}$-in. thick copper throughout, and a really tough job. All plates were beaten over cast former-blocks, the whole then riveted and brazed. The seven tubes $\frac{7}{8}$ in. outside diameter and twenty-one $\frac{3}{4}$ in. diameter, were fitted and brazed. The complete boiler has been tested and withstood 170 lb. per sq. in. pressure. A header casting is fitted and carries six superheater tubes, single return, $\frac{5}{16}$ in. diameter.

The backhead is fitted with a manifold which supplies steam to all points and is arranged to isolate all steam to valves, etc., leaving only the pressure-gauge under steam.

The regulator is the correct type situated in dome; top-feed is the usual type with inverted spring-loaded valves, with spray feed of injector water. Ashpan is fitted with working damper doors and lever-operated on footplate, situated on the right-hand side.

Four safety-valves are fitted and set to blow at 100 lb. per sq. in. Other details include drivers' tip-up seats, sliding windows, and wing windows outside of cab.

A working ejector is provided to create vacuum brake to train, and is fitted with two steam and two ejector cones and exhausts through two rings of holes in ejector exhaust-ring around the petticoat.

The boiler is completely lagged with asbestos covered by sheet brass; the dome cover, top-feed casing and pipe casing, are made from 1/32-in. thick copper or brass, according to its use. The mechanical lubricator boxes are used to gravity-tfeed he driving axleboxes.

Brake gear on engine is steam operated, with compensated pull-rods, and two brake-blocks per wheel are used as in the prototype. The inside connecting-rods are correct, with keep and cottered big-ends. Four air relief-valves are fitted close to the steam inlet. Mechanical lubrication to cylinders only is a design of my own based on the original, and consists of four plungers spring return, actuated by a four-throw crankshaft, *via* a ratchet-wheel fixed to the rear of the pump eccentric, four suction and eight delivery check-valves.

The tender is fitted with hand and steam brake, water pick-up, compensated brake-gear and all the usual fitments, with a copper water tank, the capacity of which is about five gallons.

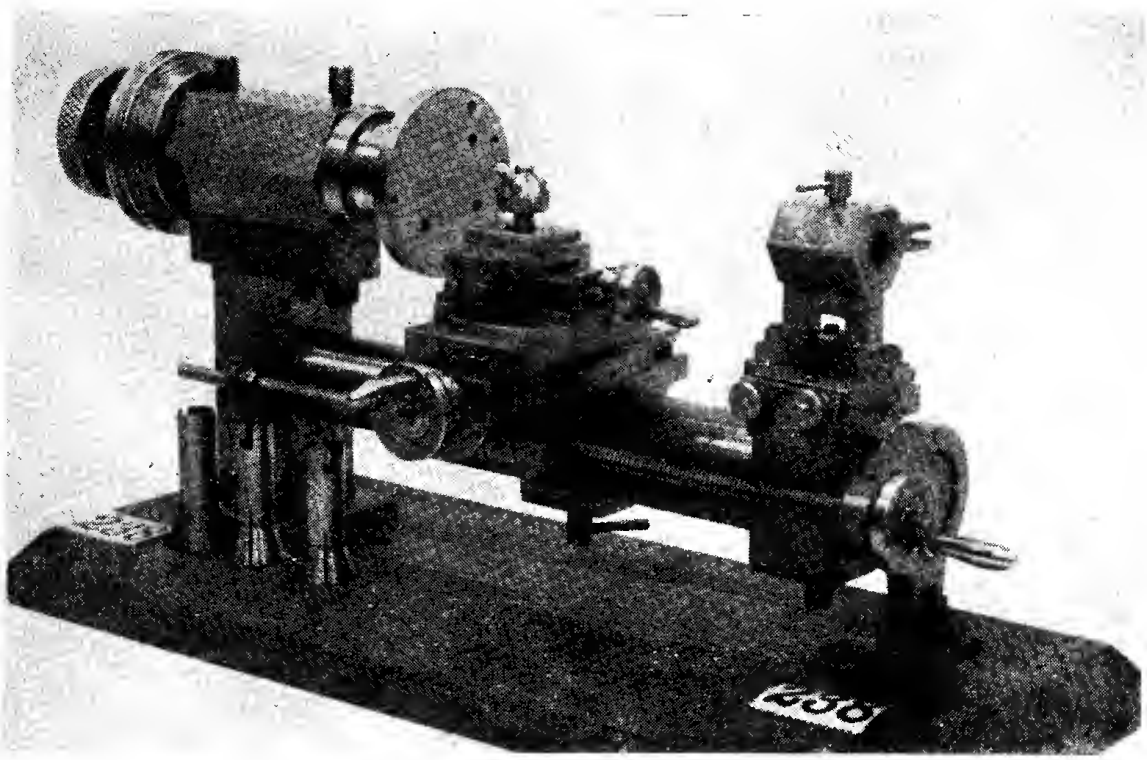
So there is a brief idea of what it takes to make up this locomotive that won for me the Championship Cup, which quite naturally makes me feel very thrilled; whether I shall compete again, I do not know; but, in any case, some time I shall show another, perhaps not in the competition. But this I know will be worth looking at, and if you have a creative spirit in you for mechanical things, I say to you, build a locomotive and satisfy that spirit, and the Cup might easily become your property.

Now, in conclusion, I wish to thank all the people who helped me when we moved the locomotive in and out of the exhibition, and hope that these few words have made, at least, pleasant reading.

Tools and Equipment at the "M.E." Exhibition

by "Ned"

SOME aspects of the exhibits in this section have already been dealt with by "Duplex," but in view of the wide variety of these exhibits, and the fact that they are of interest to all readers, no harm will be done by giving some further comments on the subject. The products of manufacturers and amateur constructors alike continue to show a steady improvement in quality and accuracy, and there is a commendable tendency to pay more attention to details of design than in former years. Some of the home-made workshop appliances shown this year were quite outstanding examples of workmanship, and obviously intended to do their job efficiently rather than to serve as makeshifts. The trade products, while following well-tried lines of development generally, with few striking innovations or brilliant new ideas, showed the same general raising of production standards.



Mr. G. F. Lock's all-fabricated lathe

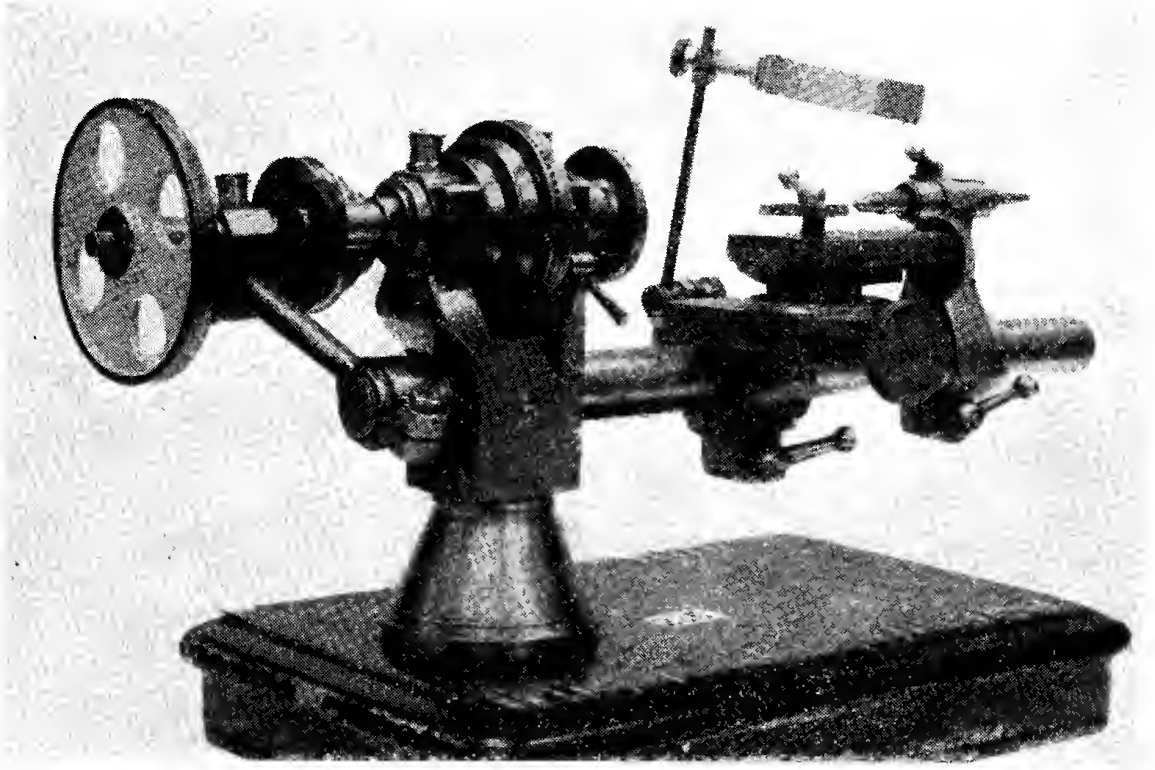
Competition Section

Several exhibitors produced small lathes, though none were comparable, either in size or elaboration, to some which have appeared in previous years. Perhaps the most ambitious example was the 2-in. lathe by L. Shepherd (No. 240) already described and illustrated by "Duplex," which had an all-enclosed headstock and countershaft, with self-tensioning vee-belt drive and motor clutch. The tailstock was of unusual design, being equipped with a set-over slide which might be extremely useful on some occasions, but a source of embarrassment on other and more normal work. An interesting feature of this lathe was the method of building up the bed from two parallel rectangular bars, placed on edge with spacers between them at either end.

The lathe by G. F. Lock (No. 238) was a little too obviously fabricated from bar stock, the hexagonal section of the headstock and tailstock housings being particularly conspicuous, though not necessarily any the worse for this, except that the length of bearing for the tailstock plunger (not fitted) appeared somewhat inadequate. The knurled locking nut for the set-over adjustment of the tailstock was also open to criticism. A set of three split collets shown with this lathe

embodied the novel feature of a bayonet catch device for the engagement of the draw-in spindle.

A lathe truly deserving of the title "model" was that shown by C. F. Toms (No. 244) which appeared to be a half-scale replica of the popular 1½-in. American type watchmaker's lathe; the workmanship and finish were excellent, and it appeared quite capable of useful work. Another practical watchmaker's lathe was that by T. J. Kellaway (No. 235), which embodied the ingenious feature of a countershaft bracket radially mounted on an arm clamped to an extension of the bed, also a magnifying lens mounted on an adjustable arm attached to the back of the slide-rest. It is a pity that this lathe was mounted on a stand apparently improvised from a somewhat dilapidated cabinet lid. The lathe by M. Lampard (No. 399) has already been referred to by "Duplex" as having a bed made of unsuitable material; it may also be noted that the section of the bed was not in keeping with the form it was apparently intended to emulate.



Mr. T. J. Kellaway's watchmaker's lathe

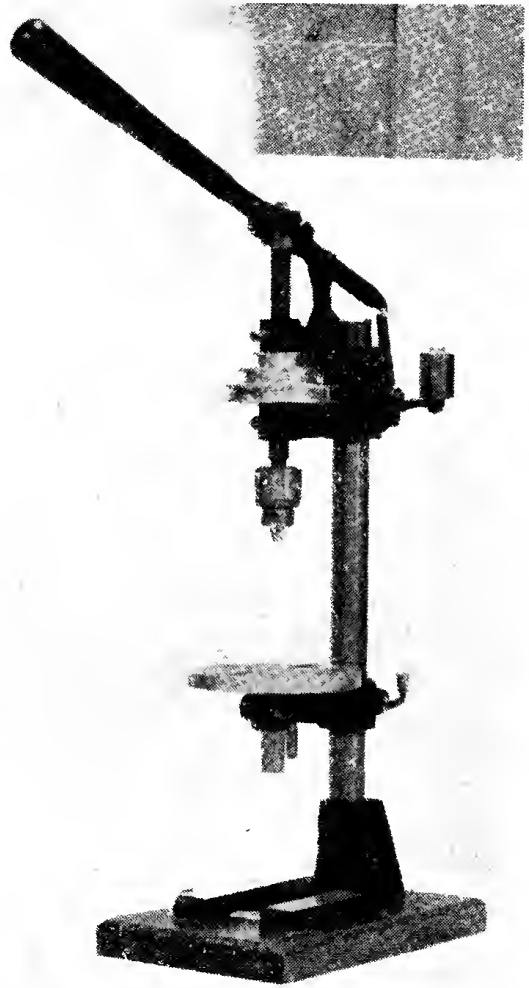
Drilling machines were, as usual, great favourites among amateur constructors, and the well-known MODEL ENGINEER design, with or without improvements or modification, was adopted in several cases. The machine by R. G. Cross (No. 229) embodied the improvements described by the late Mr. F. Wedge, and that by R. L. J. Limmer (No. 236) had an ingenious dividing appliance fitted to the table arm which could be put to good practical use in spacing holes equally round a circle (see illustration in the recent article by "Duplex"). R. Thurley produced a machine following the general lines of THE MODEL ENGINEER design (No. 243) but with all main components in aluminium alloy, a policy which simplifies production, though the choice of this material for the table and certain other wearing parts is open to question; the workmanship on this machine, however, was well carried out.

More than one of the drilling machines seen on the trade stands, it may be noted, were an obvious follow-up of THE MODEL ENGINEER design, though some examples were somewhat crude in details, and not too well executed.

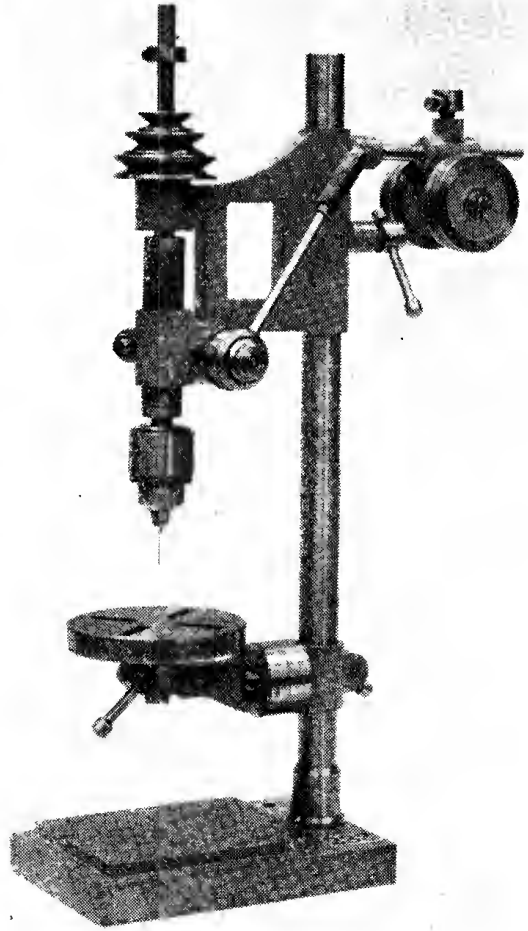
The drilling machine by W. C. Holbird (No. 233) bore a resemblance to the well-known Champion machine, and was very well built; while that by W. Wright (No. 400) appeared to be basically founded on a proprietary set of castings, with the addition of a vertical motor platform, which enabled the desirable feature of a direct belt drive, without the use of jockey pulleys, to be incorporated. Certain details of this machine, such as the feed lever, were a little on the clumsy side, though the general execution was good.

It may be observed that both the last-mentioned machines had tables with angular adjustment, a feature which undoubtedly has its practical advantages, but is by no means an unmixed blessing, owing to the difficulty of ensuring exact squareness of the table for normal use, unless a careful test is made each time it is

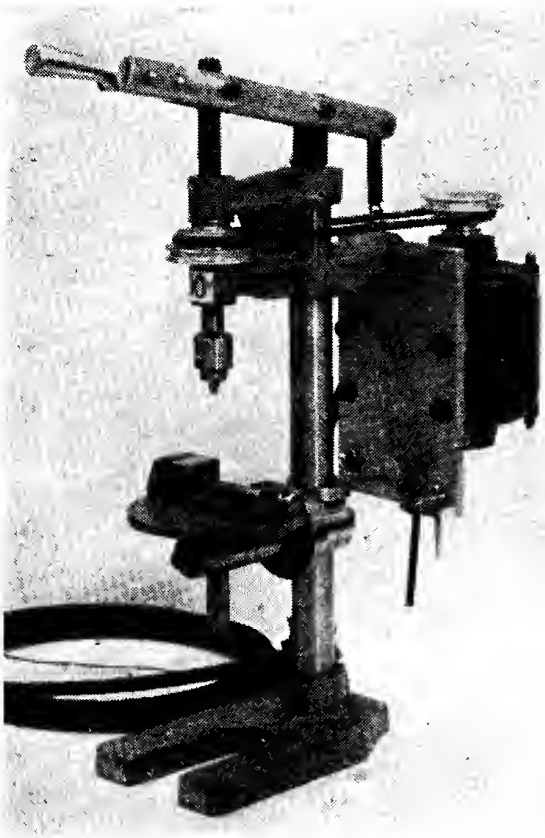
A modified "M.E." drilling machine by R. G. Cross



An "M.E." type drilling machine in light alloy by Mr. R. Thurley



Mr. W. C. Holbird's drilling machine

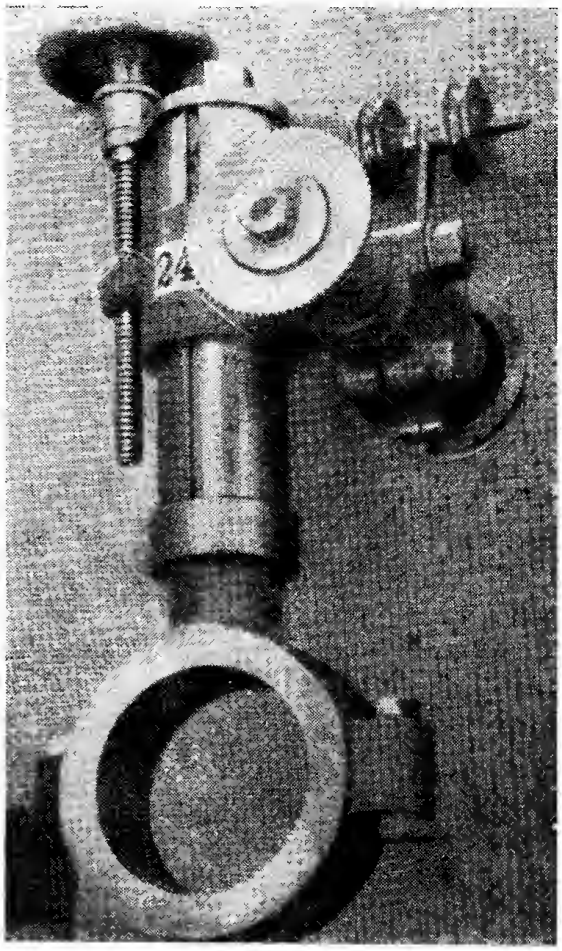


A motorised drilling machine by Mr. W. Wright

returned to zero. Angular drilling operations occur relatively infrequently, and can usually be dealt with by other means than tilting the table.

Among other items of workshop equipment in the tool section, milling and dividing attachments were duly represented, and these included a Potts type milling and drilling spindle by R. L. G. Limmer (No. 237), and a pillar-type milling spindle attachment for a round-bed Drummond lathe by W. C. J. Truscott (No. 245). The latter was equipped with a circular clamp to fit directly to the bed of the lathe, and it is interesting to note that by fitting it in this way neither longitudinal nor cross-traversing movements are possible, the only available feed motion of the spindle being radially to or from the bed. The term " universal " used by the constructor applies therefore only to adjustments and not to movements ; while the maximum rigidity should be attainable with such a method of attachment, its practical utility would be much widened if the pillar were designed to mount on the cross-slide of the lathe in the usual way.

The dividing head by R. R. Watson (No. 247) is an outstanding piece of workmanship, and appears to be a fairly faithful miniature reproduction of the type of appliance used on high-class universal milling machines, being equipped for direct and differential indexing, with provision for gearing up to the lead screw of the table for spiral milling. A more rugged device in this class was the dividing head by E. W. Bedingfield



A pillar-type milling attachment for 4-in. Drummond lathe by Mr. W. C. J. Truscott

(No. 225), which was equipped with a poppet for dealing with work between centres, but its practical utility was beyond question. Both these appliances, particularly the latter, are presumably intended for use on milling machines rather than as lathe attachments.

(To be continued)

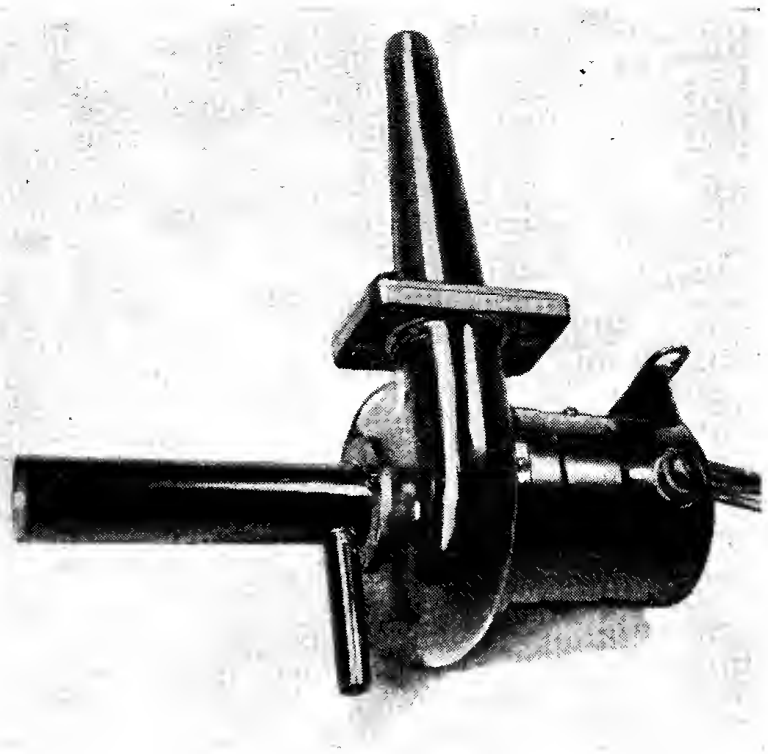
For the Bookshelf

The Steam Lorry, 1896-1939, by R. W. Kidner. (The Oakwood Press, Tanglewood, South Godstone, Surrey.) 22 pages, 4¾ in. by 7¼ in. Illustrated. Price 2s. 6d. net.

This is a well-produced handbook giving a concise history of an essentially British form of transport. Practically every known form of steam lorry is illustrated, and there is one diagram showing the eight principal arrangements of these once-familiar vehicles. In the appendix is given a list of builders, and it may surprise most readers that there are no fewer than fifty-five of them. We have found this little book most interesting, and cordially recommend it.

Building a Gas Torch

by A. R. Turpin



The gas torch with reducing nipple in nozzle end

MOST workshops contain a blowlamp of sorts, and this is usually of the pint, or smaller size, which is quite inadequate when large jobs have to be done, such as brazing a boiler or melting a crucible of bronze.

For doing this kind of work a gas torch is ideal, and a simple blower can be made from one of the many "surplus" aircraft ventilator and heating fans now available at a very low cost.

When the writer called at the local "surplus" stores, there were three types available, each of a different size.

The medium size was chosen, but the smallest would have been adequate for the job, as it was found later.

The blower purchased was labelled Ref. No. 10. BK/115, and consisted of a series-wound motor with a duplex winding, one for twelve volt supply and the other for twenty-four volts. The rotor and stator are both built up on laminations and so can be used on d.c. or a.c. supplies. It was found, however, that approximately a 25 per cent. increase in voltage was required on a.c. to obtain the same output.

The armature runs on ball-bearings and is housed in a light aluminium shell which in turn is secured by four screws to a heavier cast-aluminium fan casing, as shown in the photograph. The air inlet is a 1-in. diameter hole left "as cast" in the centre of the casing and the outlet terminates in a rectangular flange machined and drilled with three bolt holes.

To convert the blower to make a gas torch is a simple matter, and details are shown in Fig. 1. 5 in. of 1-in. diameter 18-s.w.g. brass tube is cut to length and to one end of this a brass flange is silver-soldered. This brass flange has three 2-B.A. clearance holes drilled in it and similar tapped holes are drilled to mate it to the inlet of the fan casing. A 3-in. length of $\frac{3}{8}$-in. diameter brass tube is fixed to the inlet tube by silver-solder to which is connected the gas supply by means of a rubber pipe. The gas connection was made on the suction side in order to boost the amount available, which it does to some extent. A modification not shown in the photograph but soon found to be a necessity was a means of regulating the air intake, and this was achieved by silver-soldering a narrow bridge-piece across the open end of the air inlet and soldering on a 2-B.A. screw as shown. A cap was then fabricated to fit over the end of the tube with a hole drilled in the centre of it to clear the screw, which was then secured by a nut and spring washer. Four $\frac{1}{2}$-in. diameter holes were then drilled as shown through both the cap and the tube, and so, by rotating the cap, the holes in the tube may be uncovered or closed, thus regulating the air input.

To make the nozzle, cut out a rectangle of $\frac{1}{8}$-in. brass the same size as the flange on the blower and drill and bore to match the existing holes. Now cut out a piece of 18-s.w.g. brass to form the cone. Use these holes to bolt to the faceplate, and bore a central hole 1 in. diameter to take the nozzle.

This can be easily done by drawing the elevation of the nozzle three and one-seventh times (see Fig. 2) and transferring this from the paper to the brass sheet. Cut this out with shears, and bend it round a length of steel rod—$\frac{5}{8}$ in. diameter will do—held in the vice. You may have to use a mallet on it. Don't bother about it being symmetrical at this stage, but get the edges to meet closely and squarely; wire up as shown in Fig. 3 and silver-solder. Clean up, and planish smooth and round on the steel rod. At the same time, hammer the last $\frac{1}{2}$ in. parallel; this can be done by tilting the cone on the rod and hammering

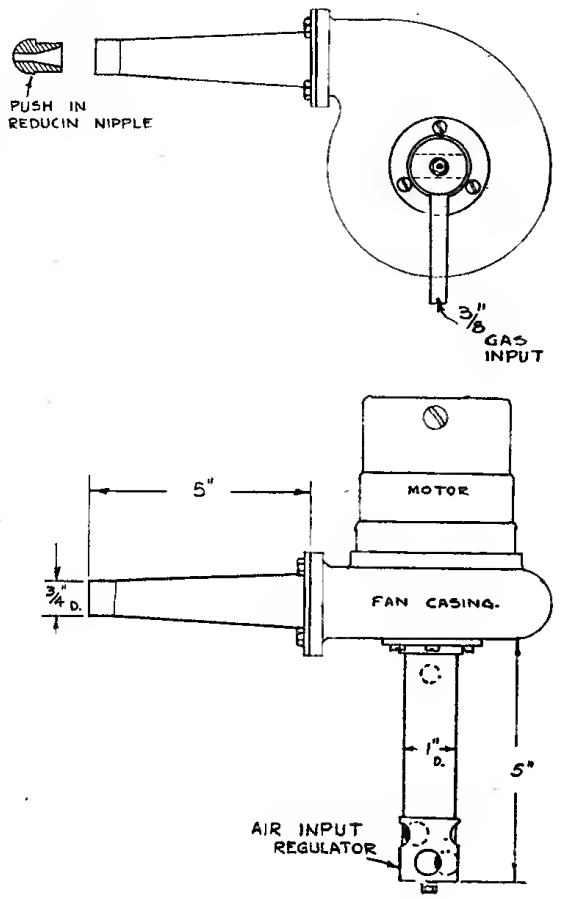


Fig. 1

gently as the cone is rotated. Now silver-solder the cone to the brass flange and the job is done.

To light up, have a match ready, close the air inlet, switch on the motor, turn on the gas and light up. The result will be a long yellowish flame. Now gradually open the air inlet and the flame will turn blue and get shorter ; continue opening up the air until you get a pronounced blue-green cone about 2 in. long in the centre of a blue flame, and there should also be a healthy roar. If the air supply is increased much more the flame will be blown out.

The torch should be capable of melting 4 sq. in. of 18-s.w.g. copper laid flat on the coke hearth in about thirty seconds.

At times a much smaller flame may be required and, although the size may be reduced somewhat merely by reducing the air and gas supplies, the flame will not be a very good shape, and it is better to reduce the size of the nozzle as well, and this can be carried out quite simply by turning up a number of different size tips and making them a push fit in the end of the nozzle (see Fig. 1).

A further attachment, not yet carried out by the writer owing to shortage of the necessary materials, is shown in Fig. 4, and consists of a length of $\frac{3}{4}$-in. dia. flexible metallic hose which is fixed to the nozzle at one end and to a length of copper pipe bent to form a torch at the other. This would make the whole job easier to handle.

As the construction of a torch of this type will usually mean an increase in the amount of silver-soldering and brazing work carried out, a few notes on this subject are given below.

Besides plain soft brass wire used for iron and steel with borax as a flux, the following Johnson-Matthey & Co. Ltd.'s silver-solders are used,

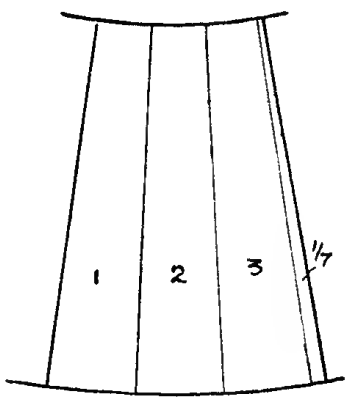


Fig. 2

details of which are shown in the table below.

Easy-flo and G6 are of high silver content and expensive, but being of different melting points, are useful when a piece of work has to be soldered twice ; for instance, in the case of the nozzle of the torch, the seam could be soldered with G6, and the flange soldered with Easy-flo, and there would then be no danger of the first joint coming apart during the second heating. Silbralloy is a comparatively cheap low melting-point hard solder, but should be used on copper and brass only.

Unfortunately, it is not very ductile and should not be used if the joint has to be worked on after fabrication.

There are many other types of silver-solders, but the writer has found those mentioned most useful. They are usually supplied by the ounce, and 20-in.

Brazing alloy	Melting point		Tensile strength (tons/in.)	Elongation (per cent.)	Bri. hards.
	Solidus (deg. C.)	Liquidus (deg. C.)			
Easy-flo ..	620	630	30	35	131
G6	705	723	28	30	121
Silbralloy ..	638	694	35	5	195

lengths and in a number of widths and thicknesses, but the writer has found 0.024 in. or 0.050 × $\frac{1}{13}$ in. the most convenient size of strip. Silbralloy in 0.050 in. × $\frac{1}{8}$ in.

The correct flux should be used for each solder. If a high melting point flux like borax is used, the flux will solidify before the solder and some may be trapped in the joint. Easy-flo flux may be used for those solders mentioned.

Mix the flux to a paste and paint on to the joint, and if the flux does not " take " easily, warm the work, give two coats of flux. When soldering small objects, the work is sometimes displaced by the boiling of the flux; this can be overcome to a large extent by melting the flux on a clean piece of steel and scraping it off when cold, and then powdering it up again.

This is known as " glass " and should be used as a paste, as before mentioned.

When using solder of the same melting point in two parts of the same job, the danger of the first joint melting can be lessened if the joint is painted with a mixture of clay and weak size, or even whiting. The same substance can be used to prevent the solder running where it is not required, but in this case a minimum of flux should be used, otherwise it will lift the clay or whiting, nullifying its effect. Remember that the solder will run to the hottest point of a joint or seam and therefore make the solder follow the flame. It will also run to the narrowest part of a joint, so see that the ends of a seam at least are closed.

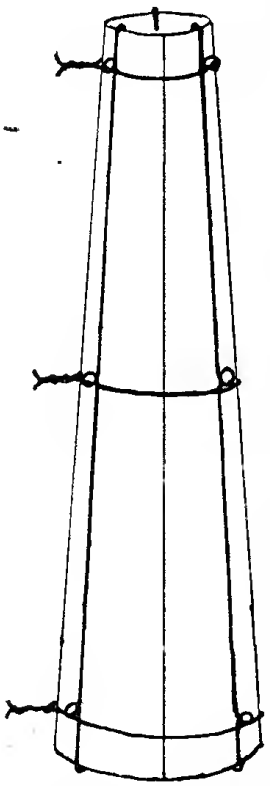


Fig. 3

When making a lapped or journal joint at least 0.001 in. clearance is required, and a close-fitting seam should either be bevelled slightly or have small notches cut in it with a triangular file to give a slight saw edge. Apply the solder to the side of the joint that shows least or to the side from which a surplus can most easily be removed. If two dissimilar sized parts are to be soldered, apply the heat to the largest part. Heat the whole of the work to prevent distortion, and, when nearing running temperature, hold the heat on the joint and apply the solder only when the work reaches running heat. If applied before, the solder may oxidise and fail to run when melted, and have to be persuaded by the application of a piece of steel wire to the globule. Scraping and fluxing the solder before use helps to prevent this.

Positioning of a small object on a curved surface is sometimes difficult, and a great help is to fix it in place with " stitches."

To make a " stitch," mark the outline of the piece to be soldered, and then with a sharp

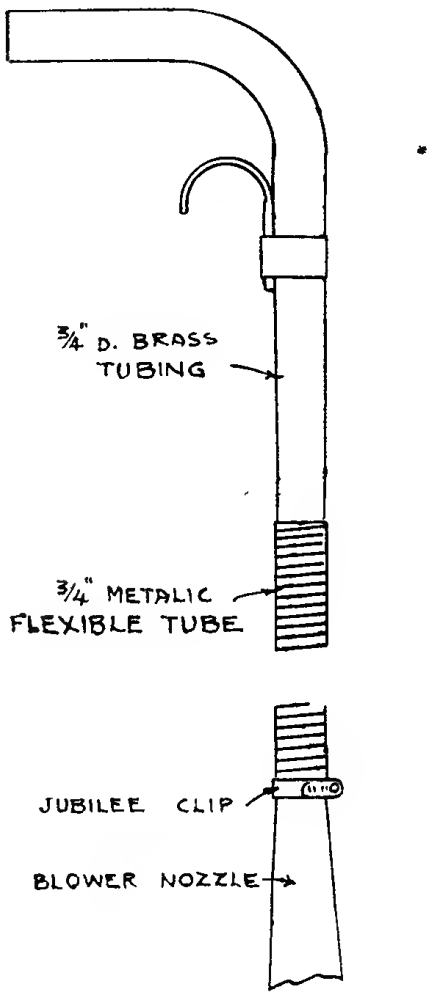


Fig. 4

graver dig into the metal, starting on the hidden side about $\frac{1}{16}$ in. from the scribed line, and push the point of the graver up to the line; this will form a curl of metal and if a number of these " stitches " are made the small projections will hold the piece in place. If the solder does not completely cover them, they may be afterwards removed with a fine file.

As cleanliness is not quite so important as with soft-soldering, the failures of most beginners are caused by insufficient heat, or insufficient heating of one of the parts. On the other hand, overheating will cause a gassy joint that will be weak and rough.

When cool, copper or brass parts should be pickled in a 5 per cent. solution of sulphuric acid; this will remove the oxide and soften the flux.

Douglas Picknell and his Work

AMONG model engineers in the Birmingham district, few were better known, and certainly none better liked or respected, than Mr. Douglas M. Picknell. Since the announcement of his death in our issue of August 19th, we have received the following particulars of his career from his son, Mr. Melville D. Picknell.

"My father had the desire to 'make things' from the time he could remember; his first lathe consisted of a yankee brace and improvised T-rest clamped to his tuck box while still at school in Torquay College. The brace is still an essential part of the workshop equipment, and the clock which he entered in the 1946 exhibition was a converted verge, the original movement of which he obtained at the age of 14 years for 3s. 6d. from a Torquay watchmaker.

"His first model locomotive was a 3½ in. gauge G.W.R. type tank engine, from drawings in THE MODEL ENGINEER, Vol. 10, 1908, and it was converted to Stephenson's link motion in 1912; this engine will pull four adult passengers easily and received a 'Very Highly Commended' diploma at the 1926 exhibition.

"The launch *Gadfly*, which recently won the steering trophy at Bournville, was built approximately in 1909; this boat was re-boilered and a new pump fitted in 1945. It received a 'Commended' diploma at the 1927 exhibition.

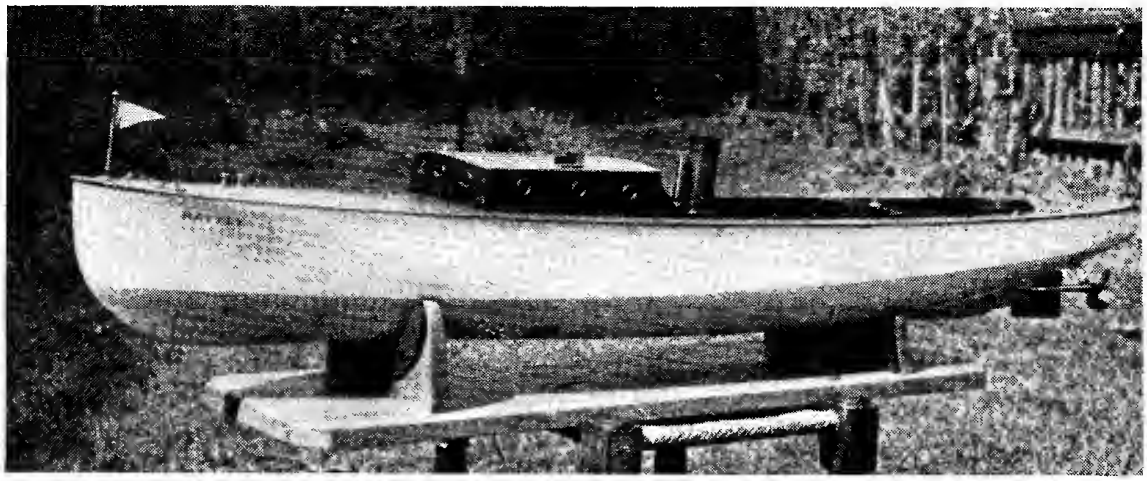
"1922 saw the completion of a motor car built in the back bedroom and fitted with a 2-cylinder Fafnir engine; the lines of this car were in advance of its day. Father covered many thousands of miles during the eight years he ran it, and never once had any trouble on the road. It was not possible to keep the car when we moved to Birmingham just after Christmas 1928, and so it was swopped for various articles of model engineering interest.

"Sir Launcelot" rounding a sharp bend during a 15-min. non-stop run on the B.S.M.E. track

"Horology was always a subject of great interest to my father, who designed and built two split-second chronometers for Messrs. John I. Thornycroft for use in their test houses. The one built in 1923 is now in Thornycroft's Museum at Basingstoke, and the one built for the Caversham Works in 1929 (I believe) is still in use there; each of these clocks stood 7 ft. high.

"Until now, I have omitted to say that his first real lathe was one he built himself, and it is still in use by his lifelong friend, Mr. Starkey of Abingdon. Father replaced this lathe by a 3 in. Jackson-Rigby in 1924, and all his work was done on this machine until about 18 months ago, when, through the kind offer of a friend, he obtained a 4½ in. Southbend.

"The 3½-in. gauge 'King Arthur' class loco-



The model 4 ft. 6 in. launch "Mayfly," powered by a 2-cylinder Thornycroft engine

motive *Sir Launcelot*, was the first model completed after moving to Birmingham; this engine was awarded a bronze medal at the 1937 exhibition. This was the year when the launch *Mayfly* appeared in the show, and was awarded a bronze medal and the 'Spectator' Cup.

"In 1935, father re-boilered and completely rebuilt an old Bassett-Lowke model of the Midland 'Crimson Rambler'; this was a very attractive model, and exceeded all expectations on the track. This rebuild was for a friend, and father was sorry to part with the engine when it was completed.

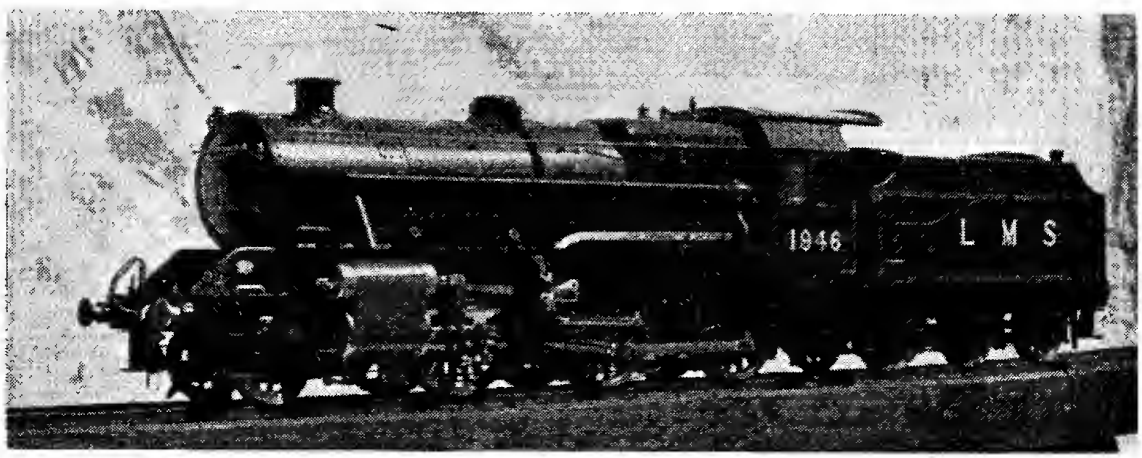
"His 2-6-0 *Princess Marina*, which was given the second award at the 1946 exhibition, is a well-known piece of work among Midland model engineers, and is, I think, the finest example of my father's skill as a model engineer. The 1-in. scale model of a Stirling single which was in course of construction at the time of my father's death would, to judge by the work so far done, have surpassed even *Marina* for completeness of detail.

"The Birmingham Society of Model Engineers, of which father was a founder member and past chairman, formed a great interest for him since its inception about 12 years ago, For the past three years he was always to be found in the thick of the work on the club track at the ground, and yet it was necessary that he should leave us within six weeks of attaining his dream of riding one of the finest model tracks in the country.

"Father was a regular reader of THE MODEL ENGINEER from the time it first appeared, and being keen on the locomotive side of model engineering, he always followed with interest the notes of 'L.B.S.C.', whose work for locomotive fans he held in the highest regard.

"I think it can be said that anyone who sought advice or information always received the best assistance that father was able to give, and he always took pleasure in giving such help as he was able.

"When one considers that all the foregoing work was a spare-time hobby, and was interspersed with watch repairs and the reconditioning of ancient clocks for friends, it can be said that not a moment of a valuable life was wasted."



"Princess Marina"

"Maid of Kent" and "Minx" Boilers

by "L.B.S.C."

THE next stage of the proceedings is to erect the firebox and tube assembly in the boiler shell. This, and subsequent operations, are the same on both boilers for the "Maid of Kent" and "Minx"; so builders of both engines who have thus far survived the "ordeal by blowlamp," and haven't yet melted down into spots of grease, take heed of the following. First of all, cut a piece of $\frac{3}{8}$-in. by $\frac{1}{4}$-in. copper bar, to fit between the bottom flanges of the throatplate; this will form the front section of the foundation ring, which (says Pat) isn't a ring at all. Neither is it a ring on full-sized engines, being a rectangular frame with rounded corners. Probably our advertisers could supply a similar frame for the $3\frac{1}{2}$-in. gauge engine, cast in copper, or plumbers' weldable metal; but it is easier, and just as effective, to make the "ring" in four pieces, same as I have described for smaller engines. Because the water space happens to be $\frac{3}{8}$ in. wide, is no reason for using $\frac{3}{8}$-in. square bar; the narrower section gives ample strength, and is easier to fit and braze in. In fact, a round-backed channel section could be used, open side up, and would automatically provide for a groove between the plates, and the sections of the ring, which could be filled up with brazing material, or Sifbronze, and would make a very sound job. This, however, would need more care in fitting, so I advise beginners and inexperienced workers to use $\frac{3}{8}$-in. by $\frac{1}{4}$-in. bar as shown in the illustrations. Clean the bit of bar, and that part of the bottom of the throatplate which it touches; round off the corners slightly, to lie snug in the corners of the throatplate flanges. It should jam between the flanges tightly enough to "stay put" whilst the firebox and tube assembly is being inserted into the boiler shell. The sides of the bit of bar should also be slightly bevelled off, so that the brazing material gets a chance to penetrate between the ring and the plates; experienced boilersmiths will know that, naturally, but it is a point usually overlooked by raw recruits and other novices.

The latter should also bear in mind that clean joints are essential for sound joints; so clean the inside of the top of the firebox shell where the crownstay flanges will make contact with it; also the flanges themselves, and the front of the firebox tubeplate all along the bottom. Then, with the shell upside down, slide the firebox and tube assembly into position, the firebox tubeplate butting up against the bit of foundation ring in in the throatplate, and the crown-stay flanges in contact with the top of the wrapper. Put a toolmaker's cramp over throatplate, piece of bar, and firebox tubeplate to hold them temporarily in place, and another to hold the crown-stay girders to the wrapper; line up the firebox with the wrapper, so that the space between them is equal both sides, measured at the throatplate. Put four 3/32-in. by $\frac{3}{4}$-in. round-head copper rivets clean through throatplate, piece of bar, and firebox tubeplate, to keep them in contact whilst brazing; drill the holes No. 41, countersink on outside, and whilst riveting, support the firebox on a hefty bit of iron bar in the bench vice, leaving enough projecting at the side, to form the "holder-up." The head of the rivet should, of course, rest on the bar whilst the stem is being hammered into the countersink. Beginners usually knock the rivets "all over the shop" in a manner of speaking; but if they aim straight with the ball end of the "Baernegum screwdriver," as it used to be known at the old locomotive sheds, and hit the rivet-shank fair and square instead of sideways, they will find the job quite simple. It's getting just the knack in addition to the knock!

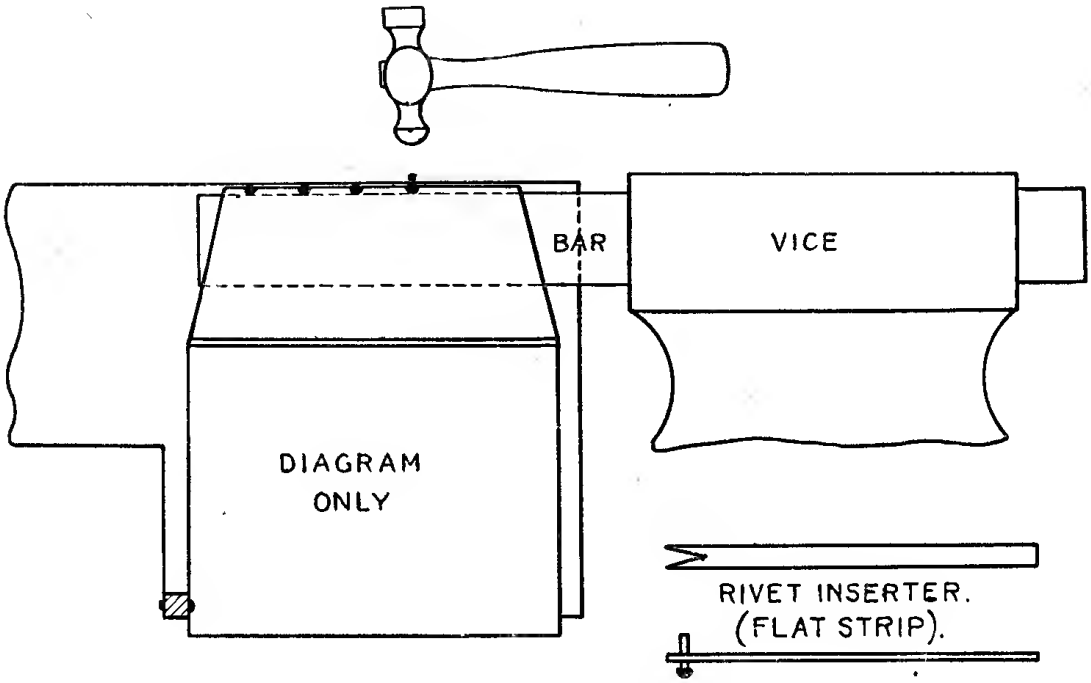
At $1\frac{1}{4}$ in. from the edge of the wrapper, drill two No. 41 holes through it, continuing right through each crown-stay flange; put a couple of 3/32-in. screws through, with nuts to hold the parts temporarily together. Then remove the cramps, and rivet the flanges to the wrapper, using 3/32-in. by $\frac{1}{4}$-in. round-head copper rivets at about 1 in. centres. These also are only for holding the parts together whilst brazing; they should be countersunk outside. When the rivets are all in, take out the two screws, and replace by rivets. The round-backed boiler will have only one row of rivets through the flange, but the Belpaire boiler will have both flanges of the girder riveted to the wrapper, as shown by dotted lines in the illustration of the backhead for that type of boiler. Smear some wet flux over the joint, to be ready for brazing.

How to Fit the Smokebox Tubeplate

Clean the inside of the end of the barrel, and the smokebox tubeplate flange, then insert it flange first, making sure it is quite upright, and tapping it down until it is barely touching the tube ends. Line up the tubes with their respective holes by aid of a wooden meat skewer—that is, if you can get one when there is no meat worth skewering—or a blacklead pencil. They will be easy enough to manipulate, as the previous heatings will have left them soft. Then carefully drive the tubeplate home, with a hammer and a short bit of wood, until the tubes stand proud of the tubeplate by about $\frac{1}{16}$ in.

Each tube is expanded into its hole by means of a taper drift. The taper shanks of broken drills do fine for tube drifts, if of the right size, but a piece of mild-steel, turned slightly taper and well polished with fine emery-cloth, does the trick. Grease it, insert into the tube end, and give a couple of sharp cracks with a hammer. The grease will prevent it sticking; but if it doesn't want to come out readily, a slight blow on the side will free it. On the L.B. & S.C.R., the tubes at the smokebox end were nearly always tightened by knocking in a taper drift; but the "boiler-busters" as we always called them, used a sledge-

hammer, and hit the drift as though they wanted to knock the tube clean through the tubeplate and the backhead as well. Strange to relate, this " hammer-and-plonk " method seemed to make the tubes keep tight, better than if the job had been done with a roller expander. The tubes were ferruled at the firebox end, but not at the smokebox end, except in a few isolated cases where persistent leakage in the smokebox had caused corrosion of the plates. This made the job of sweeping the tubes rather awkward, as the ferrules tore the flax out of the eye at the end of the tube-rod. Ned, the fireman of " Stepney," said that one of my curls would do fine to poke through his tube-rod when he went tube-sweeping, they were a bit finer than flax!



How to rivet crown-stay flanges

Next Brazing Stage

We have now arrived at a point where the boiler gets rather heavy and awkward to handle, so if you can enlist the services of a mate, do so, it will make the job much easier, especially on the brazing. The smokebox tubeplate receives attention first, and the *modus operandi* is the same as I have described for smaller boilers. A tray of some sort is needed; a discarded tea-tray, or a piece of sheet-iron bent up at the corners. Cut a hole in it, big enough to admit the boiler barrel, and put it over the barrel about 3 in. or so from the tubeplate. Up-end the boiler, and stand it on some support, so that the end of the barrel is about 3 ft. from the ground. Prop up the " holey " tray at the right height, with a couple of bricks, or anything else that won't be affected by heat, and pile up coke or breeze all around, to the level of the tubeplate. Put some wet flux all around the circumferential joint, and around the tube ends. Now, if you own, or can borrow another blowlamp, this is where the mate comes in. Even a small son or daughter who can hold a blowlamp steady, and isn't afraid of the roar and the heat, will do the job satisfactorily; I know two or three youngsters who would be only too delighted to take a share in building " a real engine." Get both blowlamps going good and strong, and whilst you are heating up the tubeplate, the mate can do ditto on the coke around the barrel, getting it to glow. When all is dull red, both the flames should be concentrated at one spot on the circumference of the barrel; operator-in-chief blowing on the inside and the tubeplate; mate directing the other flame at precisely the same spot outside. When bright red appears, apply the brazing strip, dipped in dry flux. When it melts and runs in, proceed as previously described, working your way right around the joint, with this variation, viz. your mate must keep the flame of the outside blowlamp working exactly in unison with your own, so that the metal is literally " caught between two fires." By that process, you will find that the brazing material will flow as easily as soft solder.

When the circumferential joint is finished, the whole boiler-end will be hot enough to permit the use of the one lamp for doing the tube-ends; and for these, a coarse grade of silver-solder is advisable. I use Johnson-Mattlley's B6, not because I've any shares in the firm, neither do I get free samples, but because I find it does the job O.K.; and that is all I care about. But any good stuff that may be available, will do; blow direct on the tube ends until they, and the adjacent bit of tubeplate, are medium red, then touch them with the strip of silver-solder. It should immediately melt, and " flash " clean around the

tube end, filling up the countersink in the tube-plate, and leaving a perfectly clean, smooth fillet, with no sign of a blowhole or bubble. Should any bubbling occur, apply the scratching wire as previously mentioned.

How to Braze the Crown-stay Flanges

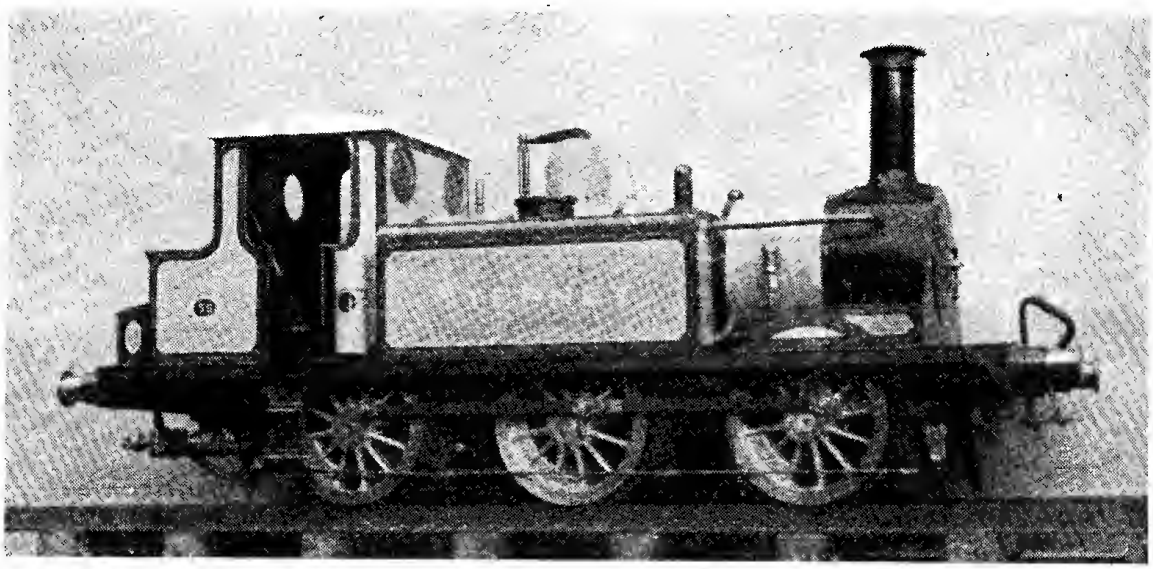
Lift the boiler with the big tongs, tip off the holed tray and coke, and lay the boiler in the ordinary brazing pan with the firebox upside down and overhanging the edge. Put a weight of some sort on the barrel, to prevent the whole issue tipping off. The flux already around the crown-stay flanges will probably be dried out, but still sticking to the job. Put a little more along both sides of each flange, then cut two strips of the coarse-grade silver-solder, and lay them alongside the girders close to the flanges. The Belpaire firebox will need four strips. Now heat up, operator blowing on the inside, and mate directing flame upwards on to the outside of the wrapper, keeping your flames in unison. Heat the whole top of the wrapper first, and the flanges ; then concentrate on one end of one flange. As soon as the silver-solder melts and starts to sweat in under the flange, get your mate to move the outside flame slowly along the wrapper opposite the flange, while you keep your flame playing on the whole length inside ; and the whole strip of silver-solder will melt and flow. By the time the end is reached, the whole issue will be mighty hot ; and then the process can be repeated, but this time the operator should apply a piece of easy-running brazing-strip, dipped in the flux, and run a fillet right along the side of the girder which has no top flange, on the round-backed boiler. This is indicated by a black triangle in the sectional illustrations. It isn't needed on the Belpaire boiler, because as long as the silver-solder sweats right under the double flange and makes a perfect joint, the strength of same will be ample.

The piece of foundation ring between throat-plate and tubeplate is not brazed at this stage, but done along with the rest of the ring ; so let the job cool to black, then carefully lower it into the pickle, and mind the splashes. Leave it for about 20 minutes as before, then fish it out, well wash in running water, and clean up.

Anybody who has oxy-acetylene apparatus, or an oxy-coal-gas blowpipe, can get along all right single-handed. Use Sifbronze, and the special flux sold for it, for the circumferential joint (I'll have to find a nickname for that, it uses up too much ink) and the crown-stay flanges, but silver-solder for the tubes, as above. No coke packing is needed ; but it is an advantage to preheat the job with a blowlamp. Use a 300-litre tip for the oxy-acet., and the biggest (No. 3) for the oxy-coal. Play on the point inside the barrel and on the adjacent point on tubeplate, until bright red, then work around, dropping spots of melted Sifbronze all along, as I have previously described, each overlapping the one behind it. Finally, apply the flame outside the barrel, going slowly around, and the ripple will melt and change to a neat fillet.

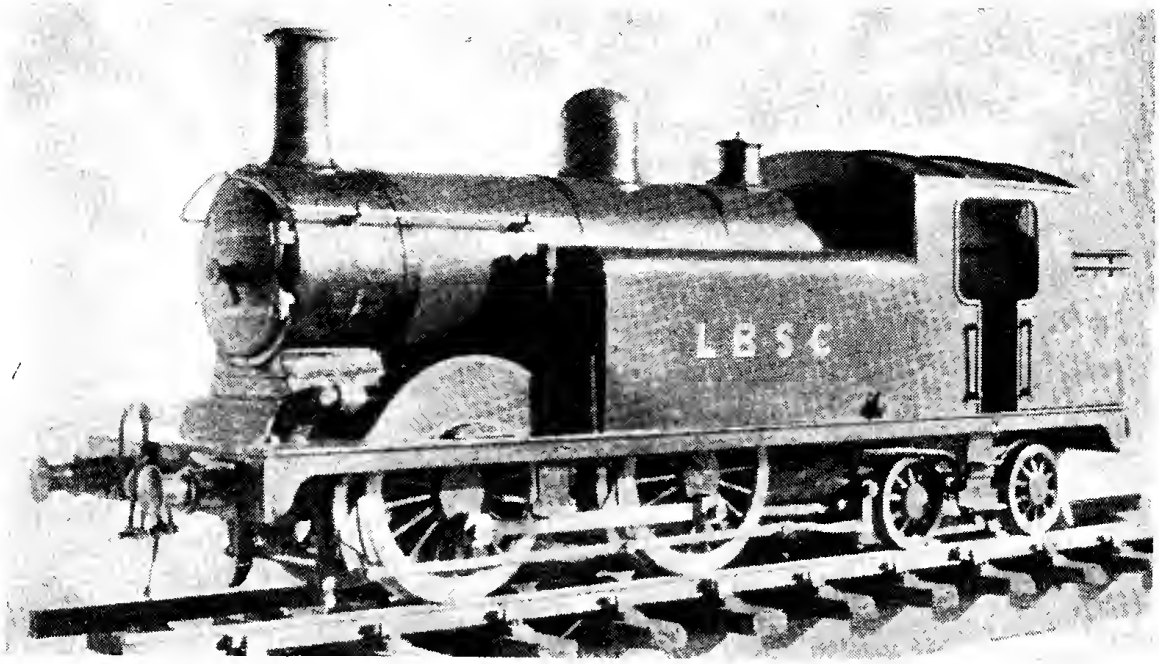
Watch your step very carefully when silver-soldering with oxygen flames, as the silver-solder is easily burnt, which will be indicated by severe bubbling. Adjust the gases so that they have a big diffused flame burning silently without the usual hiss. Direct the flame around the tube end, and as soon as same turns medium red, touch it with the silver-solder, and *don't let the flame lick the silver-solder again after it has melted and run around the tube.* " Let well alone " is the motto to be followed here.

For the crown-stay flanges, heat up by applying flame first inside and then out. When hot, concentrate on one end of the flange, drop a few spots of Sifbronze at that spot, and when it runs, shift the flame to the outside. As the Sifbronze inside melts and flows, move the flame slowly along



Mr. L. G. Tucker's 5-in. gauge " Terrier " in L.B. & S.C.R. colours

outside, applying the Sifbronze inside direct to the copper ; sounds a bit tricky, but really it is quite easy. I have no trouble in getting a lovely fillet the full length of the girders by this means ; the two friends who saw " Grosvenor's " boiler at this stage remarked on it. In passing, I might mention here, that I have received from time to time, complaints from readers who have used



Mr. G. Morgan's 2½-in. gauge L.B.& S.C.R. " D bogie "

ordinary brazing-strip with oxygen flames, and got porous joints. Whilst ordinary brazing strip is quite suitable for use with oxy-coal blowpipes, if used with care, it is not so suitable for use with oxy-acetylene, owing to the heat of the latter burning out the zinc content. This is indicated by a bluish flame and clouds of white smoke, which isn't good to inhale. The only way to get good results is to use a big tip, and regulate the gases to get a quiet diffused flame, same as with silver-solder. An experienced user could probably manage ordinary brazing strip with an oxy-acetylene blowpipe working normally, but whilst Sifbronze is available, there is no object in it. I've never burnt a Sifbronze joint yet !

How to Fit Backhead and Foundation Ring

Clean around inside the edge of wrapper, and also the backhead flange. Measure distance from top of wrapper to lip of firehole-ring, transfer it to the backhead, then set out the size of the firehole-ring on the backhead at the marked location, cutting the hole a little smaller than the marked lines indicate. Then offer up the backhead to the wrapper, and note if the firehole is in the right place. If O.K. enlarge it all around with a file, until the lip on the firehole-ring will go through. If the hole is " out," you can see at a glance which side needs the most filing to put matters right. When true, put the backhead in place with the lip of the ring through the hole, and beat the lip downwards, on to the backhead, same as the other lip was flanged over the firebox door-plate. The backhead will now be held in position, the ring forming a substantial stay.

Cut a piece of ⅜-in. by ¼-in. copper bar to fit between the backhead flanges at the bottom, same as throatplate, rounding the corners and bevelling off as already mentioned. Jam it in place between backhead and firebox, making sure that the overlap is the same at both ends. Put it in far enough to allow the backhead to project about $\frac{1}{16}$ in. beyond it, then rivet through the lot, same as the throatplate section. Both sides of the firebox are treated to a dose of the same medicine. The pieces of ⅜-in. by ¼-in. bar should be $\frac{1}{16}$ in. clear of the edges of the wrapper sheet, giving the brazing material a little " wall " to build up against, when forming a fillet. If there are any spaces between the side and end sections, plug them up with little splinters of copper driven in tightly, otherwise there will be stalactites of brazing material inside the boiler when completed ; nice things around which deposits of " fur " and scale just love to accumulate.

Go all around the edge of the wrapper with a lead or other soft-faced hammer (I use a hide one ; we used to call them " bacon-rind " hammers on the railway) and beat it into close contact with the backhead flange. If it won't " stay put " of its own free will and accord—it *should* do, after being softened by the previous brazing jobs—teach it manners by inserting a few stubs of screwed copper wire. Squeeze the edge of the wrapper close to the flange with a big cramp, or by holding the lot in the bench vice ; drill No. 48 holes at the offending spots,

(*Continued on page* 410)

NEEDLE ROLLER-BEARINGS

by "Don"

IN my two previous articles (THE MODEL ENGINEER, July 10th, 1947, and July 29th, 1948), I attempted to deal fairly comprehensively with orthodox ball- and roller-bearings, the application of these in one or the other forms being universal.

I would now like to deal with a bearing which, in spite of its many limitations, should be of immense value to the model engineer. I refer to the roller-bearing popularly known as the

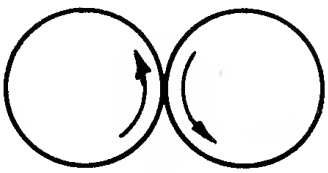


Fig. 1

"Needle Roller-bearing" or simply "Needle Bearing." The name, of course, refers to the fact that the rolling elements have a length greatly in excess of the diameter, and since the bearing found great popularity on the continent, the rollers are usually (though not necessarily) to be obtained in mm. diameters and lengths. A point that must be stressed at the outset is the fact that they are not designed to take the place of orthodox ball- and roller-bearings, but are for use in applications where the disadvantages peculiar to the design are not detrimental.

Disadvantages

Dealing with these disadvantages at the onset is rather like "putting the cart before the horse," but nevertheless an understanding of where and where not to apply will save quite a lot of heart-ache at a later stage. Firstly then, to operate efficiently, the needle roller-bearing must have ample diametrical clearance (see article dated July 10th, 1947, for an explanation of this term). Approximate minimum figures are shown in Table I. Extended tests have shown that the roller revolves about its own axis only when passing through the loaded zone; thereafter it simply skids. This, of course, applies to a bearing with correct d.c.

In a bearing which is tight, however, the rollers revolve around their own axis all the time and since the bearings are "full type" (that is there is no separating cage) the rubbing faces of adjacent rollers are moving in opposite directions (see Fig. 1), severe friction is therefore set up and at higher speeds this produces excessive heat which in due season causes the bearing to fail.

ROLLER P.C.D	MINIMUM DIAMETRICAL CLEARANCE
UP TO 1·5"	·0008"
ABOVE 1·5" & INCLUDING 2·5"	·0012"
" 2·5" - " 3"	·0014"
" 3" " " 4"	·0018"
" 4" " " 5"	·0021"

Table 1

Secondly, due to the fact that the rollers are comparatively long and also to the fact that no separating cage is used, skewing of the rollers when not in the loaded orbit is quite a common occurrence. This again is extremely detrimental, as jamming is liable to occur. Thirdly, although made to very fine limits of accuracy, a certain amount of taper is present in all needle rollers, and if coupled to this, the tracks are also tapered, the rollers tend to work themselves towards one or the other end of the track, and severe friction is set up between the ends of the rollers and the face of the track shoulder.

After that rather dismal catalogue of woes, the advantages of this type of bearing are also very numerous, the principal one being the very small amount of space required to accommodate it. (Fig. 2, which is to scale, shows the comparative sections of (a) a needle roller-bearing, (b) a light type roller-bearing of equivalent bore, and (c) a medium type roller-bearing of equivalent bore.)

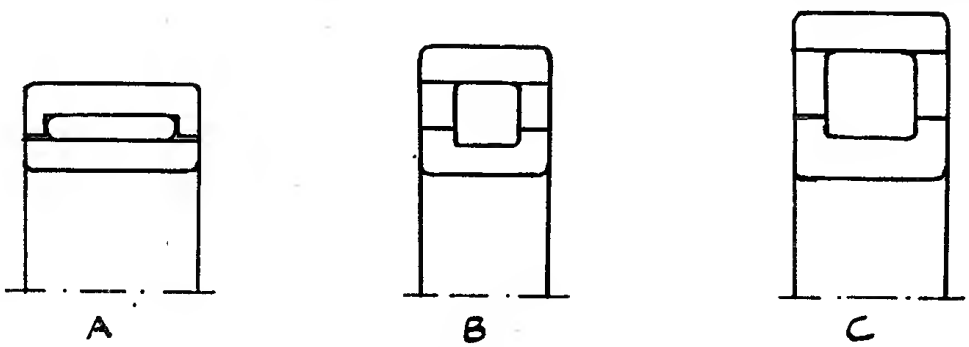


Fig. 2

Mounting

When a needle roller-bearing is supplied as a complete unit, the rings are made to the same exacting specification as a normal ball- or roller-bearing and thus can be mounted in exactly the same way. Sometimes, however, it is more convenient to use one ring and rollers only; alternatively, the rollers only may be used and Fig. 3 shows how this may be accomplished. The first sketch shows the use of a needle roller-bearing outer ring and rollers only, the shaft being used as the inner track. To utilise the full load-carrying capacity of the bearing, the shaft must be either direct or case-hardened to give a hardness of approximately 64 Rockwell C scale and must be to as fine a finish as is possible to obtain. Any reduction below this hardness figure will give a correspondingly lower load-carrying capacity. The remaining two sketches, show schemes using needle rollers only, the tracks being formed in the outer and inner members respectively, and the remarks *re* hardness and finish, applying equally as for the first scheme.

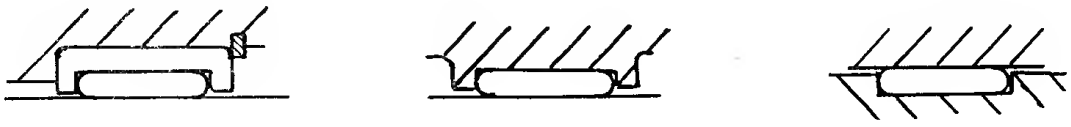


Fig. 3

Fig. 4 shows a typical assembly to an enlarged scale. This has been done to illustrate the various dimensions, so that any reader contemplating using such an arrangement, may make the requisite calculations. Using the pitch circle diameter of the rollers as a basis, the first dimension is the circumferential clearance of the rollers. This should be 0.0001 in. per roller plus 0.005 in. up to a maximum of one-half of the roller diameter (when large diameters are involved, using large numbers of rollers, this formula may well give a clearance greater than one-half of the roller diameter and in cases such as this, the latter should be the figure used). Now the inner track diameter may be fixed. This is simply the P.C.D. minus one full roller diameter and the tolerance should be plus 0 minus 0.0005 in. Next comes the outer track diameter and this is the inner track diameter plus two full roller diameters plus the diametrical clearance as given in Table I. Finally, the track width should be the roller length plus 0.010 in., and the shoulder diameter must be something greater than the P.C.D. and less than the outer track diameter for shouldered inner types and less than the P.C.D. and greater than the inner track diameter for shouldered outer types. One of the disadvantages of the orthodox needle roller-bearing not previously mentioned, is in the fact that it is not in the strict sense of the word, a self-contained unit. By this, I mean that if the inner ring is withdrawn, the rollers fall out of position. This can be extremely awkward during assembly and disassembly, particularly on large units where a great number of rollers are being used. A great deal of thought has been expended to combat this feature and Fig. 5 shows three such devices. The first two are covered by patents held by Messrs. Ransome & Marles and the third by the Torrington Company of America. It will be noted that the latter two schemes have incorporated a special form of needle roller which has pips or trunnions on the ends to enable the retention device to adequately retain the rollers in position in the outer member.

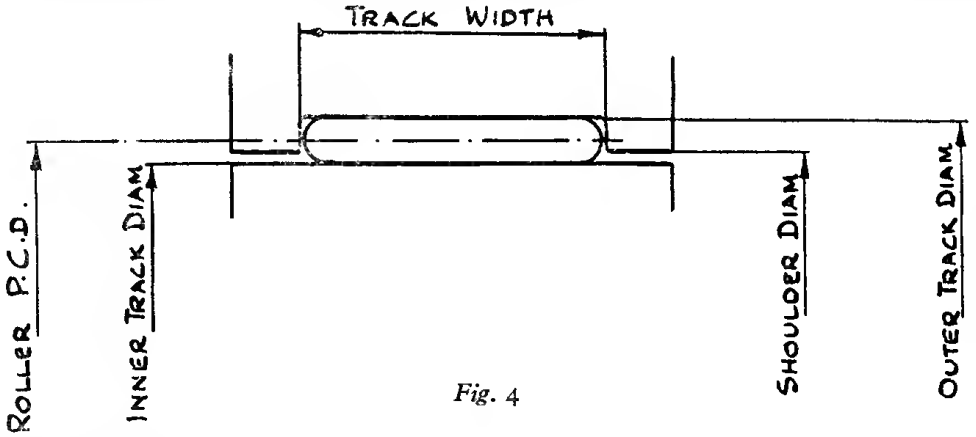


Fig. 4

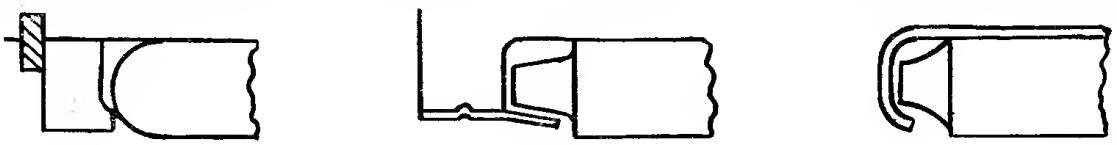


Fig. 5

Location

In common with most parallel roller-bearings, the needle roller-bearing is essentially a journal unit only, and cannot be used as either a location bearing or for thrust duties. Separate means must be introduced to cater for these and this is best accomplished by either a ball-bearing where thrust loads are encountered or rubbing plates where simple location only is required.

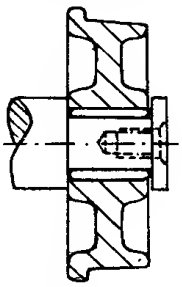


Fig. 6

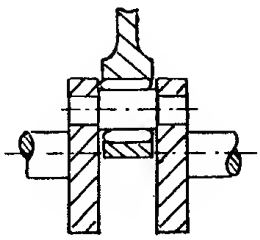
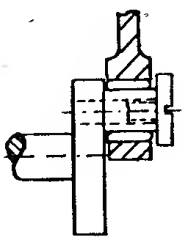


Fig. 7

Application

The needle roller-bearing, in all its varied forms, is particularly suitable for those applications where semi-rotary or oscillatory movement is required. In such applications, plain bushes tend to wear oval at the point of application of the load. Needle rollers, however, have operated for many thousands of hours with no measurable wear. Such mountings as valve rockers, brake camshafts, universal joints, etc., have benefited enormously from the fitting of needle rollers.

As far as model engineering is concerned, the possibilities are profound. Fig. 6 shows a suggested wheel mounting. Location is effected by plates rubbing on the wheel boss and it is suggested that modifications of this scheme should be particularly suitable for the non-driving axles of locomotives, also for rolling stock. In this case, although the journal may be hardened, the outer track which is actually the wheel bore, cannot be (presuming cast-iron wheel) and so the subsequent drop in bearing capacity must be tolerated, although this would be ample for most average jobs. Fig. 7 shows two suggested big-end mountings and here the location is *via* the crankshaft webs. It should be possible to attain a reasonable hardness for both the crankshaft and the con-rod bore, thus the bearing would be suitable for the higher loads encountered. A suggested mounting for a gudgeon-pin is shown in Fig. 8. Of course, this is for the larger size of engine, as the smallest practicable inner track diameter is usually reckoned to be 0.229 in. diameter using twelve 2-mm. diameter rollers. Finally, Table 2 gives a list of what are generally taken to be standard needle rollers, and these are normally available "off the shelf."



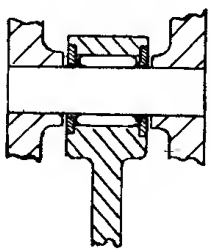


Fig. 8

Diam in m/m	Length in m/m
2·5	9·8
2·5	13·8
2·5	15·8
3	15·8
3	19·8
3	23·8
3·5	29·8
4	39·8

Table 2

"L.B.S.C." (*Continued from page* 407)

tap them 7-B.A., and screw the stubs of wires in, cutting them off flush. Don't use brass screws, or on the final brazing job you'll find only the holes and no screws.

It Makes One Think!

The other evening I stood by my little railway, wondering when I was going to find time to put the automatic gear on the signal (I have it all ready) when I heard a deep-toned whistle, and the noise of an approaching train on top of the bank. In a few seconds it went by; the night boat train, consisting of eleven coaches, including a 12-wheel Pullman car, and two vans. The engine was an Atlantic, old "Ayesha's" big sister, and she was going up the 1 in 264 at a good clip, as nonchalantly as you please, just a moderate blast and never a spark from the chimney. A fine sight, and one which made my nearly-worn-out heart beat just a little faster.

Two evenings later, I stood in a friend's garden within sight of the old S.E. & C.R. main line just south of Ashford Station. There was another whistle, and the sound of another train; in a minute or so, that one went by. It was the Charing Cross-Folkestone express, consisting of ten coaches, two of them Pullmans, headed by what the Southern enginemen facetiously call a "spam can." She was going up the 1 in 850, after a previous descent and a short level stretch, making jolly hard work of it, with a lot of noise, and a tremendous shower of "golden rain" shooting skywards from the top of the "can"; whilst to call the beats syncopated, was praising them. My mind went back two evenings—'nuff sed!

"Duplex" Visits The Machine Tool Exhibition

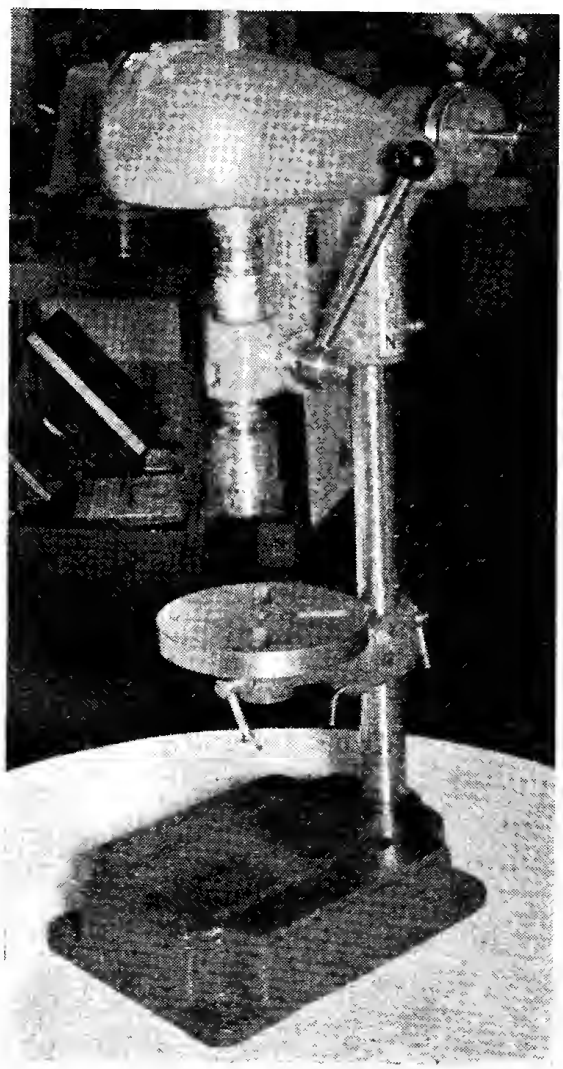
THIS year the exhibition was visited on several occasions, mainly with a view to finding out what was available in the way of new tools and equipment of interest to the amateur and the user of the small general workshop.

Although, at first sight, we appeared to be confronted by a massed assembly of large and expensive machinery, nevertheless, a careful and searching inspection of the stands showed that there was a representative display of small high-class machinery and equipment suitable for the use of the manufacturer and amateur alike.

The most noticeable advance seemed to be the general use of cemented carbide-tipped tools for all general machining operations; this meant that not only were the rates of machining greatly increased, but at the same time the use of cutting fluids was no longer necessary, and it struck us that the loss of working time due to industrial skin troubles should be greatly reduced in consequence. In this connection, we were enthralled by the sight of a Ward lathe taking a heavy cut along a steel billet, of some 18 in. in diameter, revolving at a surface speed of 750 ft. per minute. Elsewhere, piles of beautifully coiled blued shavings on many stands showed that carbide tools were in operation and that coolants were no longer in use.

These observations renewed our interest in cemented carbide tools, for although we have used them for the past twenty years, it has been chiefly for work that was too much for an ordinary high-speed tool, such as turning hardened ball-bearing races and machining chilled sand castings.

As far as the amateur is concerned, the rapid removal of metal is not of paramount importance, and accuracy of machining is maintained by avoiding the high cutting stresses involved in this process. On the other hand, the high cutting speed permissible with these tools means that metal can be quickly removed even with a fine feed. It would appear from the makers' instructions, for example, that, a cast-iron faceplate of 12 in. diameter can be finish-turned when using the slow direct mandrel speed of some 200 r.p.m. The opportunity thus afforded of dispensing with the use of the back gear when turning cast-iron, and with lubricants when machining steel, will be welcomed by most lathe users, and the better finish so obtained is an added attraction.



The Champion No. 2 ⅜-in. capacity drilling machine

With this in mind, we hope to deal in detail with the whole subject in a future "In the Workshop" article, and at the same time an attempt will, it is hoped, be made to describe efficient and economical methods of sharpening these tools, as well as the tool equipment suitable for general lathe work.

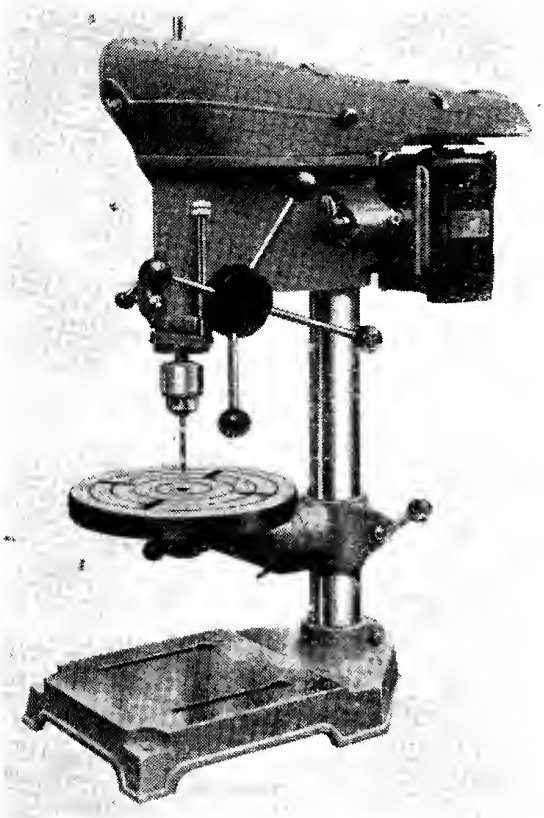
Lathes

From the amateur user's point of view there is, unfortunately, not very much that can be said about the majority of the lathes exhibited, for they are mainly either too large, too specialised for a particular class of work, or too expensive; nevertheless, a close inspection of one of the smaller tool room lathes, such as the Harrison of 4½ in. centre height, will certainly be well repaid.

This lathe has a self-contained motor drive taken by V-belts to a friction clutch controlled by a hand-bar extending the whole length of the bed. The mandrel runs in pre-loaded Timken roller-bearings, and three rates

of feed for the saddle are provided by the small gearbox driven from the quadrant gears and connected to the leadscrew and the separate feedshaft.

The inverted V-type bed is fitted with a removable half-gap piece to give greater support to the saddle when working close to the headstock. A wide range of extra equipment is available, including a taper turning attachment, draw-in mandrel collets, and milling and gear-cutting attachments.



The Kerry drilling machine

A visit to the stand of Messrs. Holbrook was rewarded by the opportunity of examining a number of lathes of beautiful design and impeccable finish.

Many of the smaller lathes, including those of the precision type, seen in the exhibition were found to lack the large boring table so useful to the amateur, and to remedy this the makers are usually prepared to supply a special boring table to take the place of the cross-slide normally fitted, but it is advisable to have this work done before delivery of the lathe.

Drilling Machines

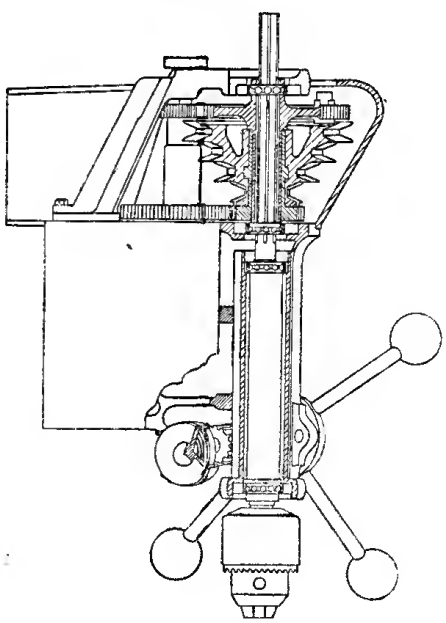
There were exhibited, wc found, several patterns of small and inexpensive drilling machines eminently suitable for use in the small workshop. The well-known Champion drill of ¼ in. capacity was shown on the stand of Messrs. Elliott, who are the manufacturers of this machine, which, as many will know, is a well-made tool, with a rack feed and tilting table, capable of doing accurate work over a wide range of drilling speeds.

This firm have recently introduced a machine very similar in design to the foregoing but of ⅜ in. drilling capacity and having a four-step driving pulley. If this machine gives as good service as its smaller counterpart, it will fill a long-felt want and should be in great demand, for many workers have in the past had to build their own machines of this capacity owing to the lack of commercial models.

There arc several makes of larger machines of ½ in. capacity exhibited which are mostly of the original American design with a self-contained motor drive. Undoubtedly, this is a most useful type of drilling machine for use in the small general workshop, but it is essential for all-round work that sufficiently slow spindle speeds should be available. As the correct speed for a ½ in. diameter carbon-steel twist drill, as commonly used in the small workshop, is given by the makers as 214 r.p.m., it follows that this may well represent the lowest spindle speed in a ½ in. capacity drilling machine; but where, as in commercial practice, the more expensive high-speed steel drills are employed, the drilling speed can, with advantage, be rather more than doubled.

Where counterbores and countersinks of even larger diameter than ½ in. are commonly made from the amateur from carbon steel and used in the drilling machine, a very low speed of some 100 r.p.m., or less, will be found almost essential.

Further, this low speed will be required if a tapping attachment is used in the drilling machine to operate the larger sizes of taps.



Section view of the Kerry drilling machine

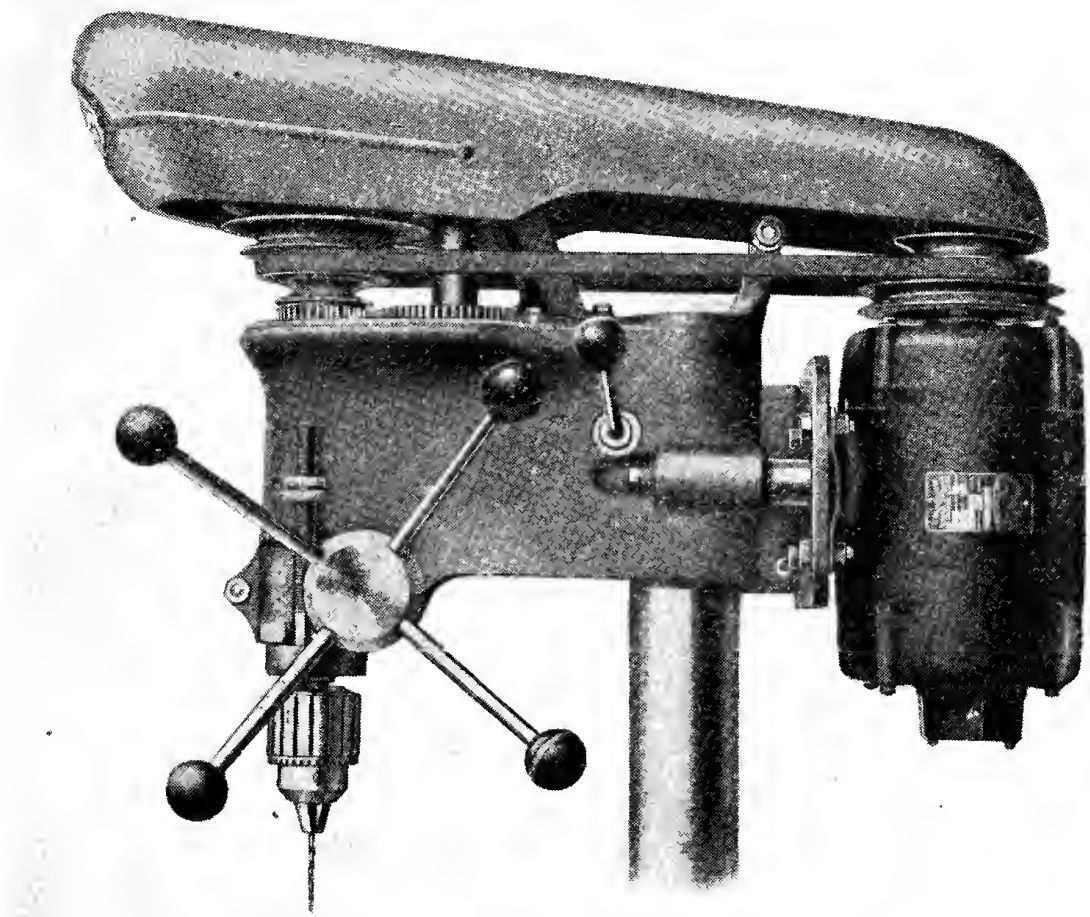
In the Kerry ½ in. capacity drilling machine a lowest speed of 86 r.p.m. is obtained by means of a pinion-driven backgear, and the highest

direct spindle speed is 3,360 r.p.m. ; in this way a total of eight speeds are made available.

The American-made Walker Turner drilling machine of this type is fitted with a two-stage belt drive which provides spindle speeds of from 165 to 6,750 r.p.m. In the well-made No. 1 Progress machine manufacturered by Messrs. Elliott, the direct V-belt drive enables spindle speeds of from 425 to 2,500 to be obtained with a standard electric motor, but when a high-speed motor is fitted these speeds are doubled.

As, when doing general work, it may often be necessary to alter the spindle speed to suit the size of the drill used, it will be found an advantage if an easy means of changing the belt on the pulleys is provided ; where a single-stage drive is fitted the length of the belt ensures that it can be readily shifted on the pulleys. To give easy access to the belt, we noticed that in the Kerry machine the belt cover guard was spring-operated so that it rose clear of the pulleys when its fixing was released.

In all the machines of this type we examined, the spindle is returned to its highest position by means of a coil spring contained in a spring-box, and set to the tension of the spring to provide a sensitive feed, the spring-box itself is rotated and then locked in position. It would, we feel, be an advantage if some of the smaller machines were equipped in this way to overcome the harshness of the feed which is sometimes experienced.



Kerry drilling machine with belt guard raised to show back gear

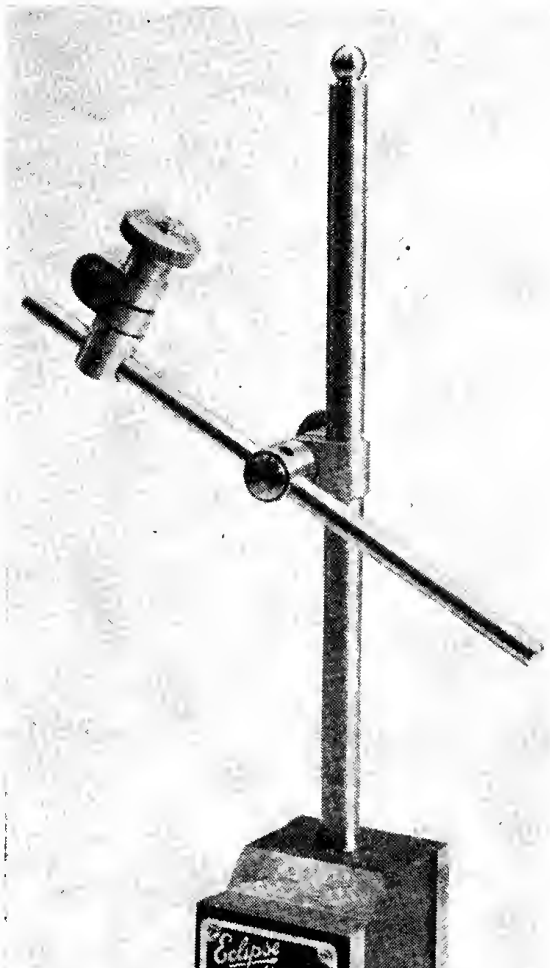
Small Tools

On the Eclipse stand much was found of especial interest to the amateur ; the surface gauges shown were very highly finished and work delightfully smoothly, and the same may be said of the new pattern cross-handled chucking tap wrench.

It is encouraging to find these products now manufactured up to the American standard, for, to the mechanically-minded, well-finished tools are a joy to handle, but using their roughly-made counterparts is merely an unpleasant necessity.

The Eclipse tool bits are deservedly popular

in the small workshop, as their ground, flat surfaces ensure that the tools lie evenly on the grinding table while being sharpened; in addition, the form of their bevelled ends greatly reduces the amount of grinding required when making the more common patterns of turning tools.

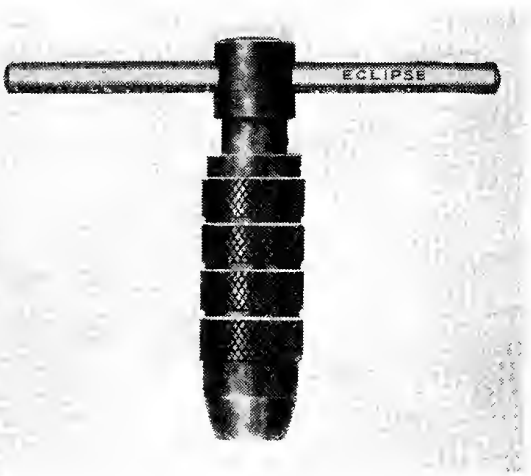


The "Eclipse" magnetic base

A good selection of angle plates and V-blocks was shown, and the latter when fitted with clamps are made in two grades: the ordinary and the precision type.

During the recent war, the Eclipse brand of permanent magnets was well known for its many and varied applications, and now in its latest form it is used in the base of a dial test indicator mounting to enable this instrument to be firmly attached in any required position on a machine table or slide. As an additional useful feature, a concavity is formed in the base to allow it to obtain a secure hold on a rounded surface such as the column of a machine. The action of the magnets is controlled by means of a small switch so that the base mounting can be located, and then firmly secured in place.

Although we have left it until last, the Eclipse stand is, perhaps, best known as representing the manufacture of the hacksaw and its blades. Here, we were glad to find that a new pattern frame to take the Junior 6-in. blades had been introduced, as for some purposes we had always regarded the wire frame as hardly rigid enough to support the thicker blade with a wavy set now standardised. The new frame is of neat appearance and nicely balanced; provision is also made for securely mounting the blade in the frame, where it can be adequately tensioned by turning the comfortable handle grip.



The "Eclipse" tap wrench

Another interesting product and one of great service to the craftsman is the new piercing-saw blade. These blades are made in a graded series suitable for all types of work; they range from a delicate blade of six thousandths of an inch in thickness with 80 teeth per inch to one of 17 thousandths thick having 32 teeth per inch. Two patterns of spring frames for holding these blades are now made, one being adjustable and the other fixed.

In view of the previous reference to cemented carbide tools, the exhibit staged by Messrs. Wickman, the makers of the famous Wimet tools, was visited with the greatest interest. Here, not only were we shown the various patterns of small tipped tools, suitable for use in small machine tools, and the wheels and diamond laps used for grinding and finish-sharpening them but a cordial invitation was extended to us to see the instructional cinema film showing the making and practical use of these exceptional lathe tools.

At the start of the film, the method employed in making the actual cutting substance was shown, and this was followed by a pictorial demonstration of how to use these tipped tools to the best advantage both to hasten production and to promote a greatly improved finish on the

work. The evil results of employing faulty methods were also depicted and the appropriate remedies were at the same time lucidly demonstrated.

On the stand of the Birmingham Tool and Gauge Co. we were pleased to find some equipment that we had long sought, namely, a range of expanding reamers smaller than the ordinary $\frac{1}{2}$ in. minimum size.

This firm exhibited a set of six expanding reamers covering the whole range from $\frac{1}{4}$ in. to $\frac{15}{16}$ in. and contained in a neat wooden case. The reamers have four blades made of 18 per cent. tungsten high-speed steel, and each has a range of expansion of 1/32 in. except that in the largest of the series this is increased to $\frac{1}{16}$ in.

When visiting the stand of Messrs. Pratt, the well-known chuck makers, we were glad to learn that the combination pattern chuck is again being manufacturered in the larger sizes. This means, we hope, that the smaller sizes of chucks will in turn be reintroduced, for this type will be found particularly useful in the small workshop for the quick and accurate centring of chucked work.

As many will know, these chucks have their jaws operated by a scroll, as in the ordinary self-centring chuck, but, in addition, each jaw carries a secondary jaw which can be set individually, as in the case of an independent chuck.

In practice, once the jaws have been set truly, round work can be accurately chucked and re-chucked solely by turning the scroll with its key, as when using a self-centring chuck.

We left the exhibition with regret that we could not stay longer, but with a feeling of confident assurance that, as long as goods of such superlative design can be produced in this country, our engineering industry will set an example that others may well envy.

Editor's Correspondence

Fowler Steam Ploughing Engines

DEAR SIR,—There is nothing unusual about the engine illustrated on page 184 of the August 19th issue. I have photographs of several of this type, but the only number is 1908; as far as I know, these engines date from 1864-70; the type with cylinders on the right-hand side was introduced in 1869. The later engines had worm steering-gear, the earlier were steered by a wheel on a vertical shaft and spur gears. Later still, in the 90's, a valve spindle-guide was incorporated in the slide-bar support.

The engine numbered 16719 seen by Mr. Boddy (Vol. 98 p. 481) is one of a pair built for the Argentine and, instead, bought by Bomford & Evershed, who still own 16720. Overall dimensions: approximately 25 ft 6 in. × 8 ft. 11½ in. Hind wheels, after reduction to suit English roads, 7 ft. × 22 in., front 5 ft. 4 in. × 16½ in. Weight empty, 21 tons. 22 N.H.P.

Yours faithfully,

Ruardean, Glos. R. C. STEBBING.

Traction Engines

DEAR SIR,—I was delighted to see three really correct models of traction engines at THE MODEL ENGINEER Exhibition.

Two were those delightful correct models of Ruston engines and the third was in the overseas exhibit, i.e. the Case engine with its attendant threshing drum and water cart, all being absolutely correct in every detail.

What a pity it is that so many people put such beautiful work into incorrect models; there is nearly always something wrong, either the spokes are on the wrong side of the tee rings or the strakes are incorrectly spaced or angled the wrong way, and the valve-gear never right; even the steering chains are nearly always too big in the link.

Before starting to make a model traction engine, a proper drawing should be obtained.

Yours faithfully,

Iffley F. J. BRETHERTON.

Driving Positions

DEAR SIR,—The appearance of "1121's" interesting article on this subject suggests the presentation at this date of some notes prepared for inclusion in a future article on a 7¼-in. gauge locomotive. For this larger gauge, the matter was approached from a rather different viewpoint.

Those who ride miniature locomotives, realise that the driving posture endured is not exactly the acme of comfort. To be reasonably comfortable, one would need, at least, a 12-in. gauge locomotive so that the feet may be placed low down between the wheels of the tender or driving vehicle. One's aspirations are hardly ever fulfilled in their entirety, and the best use should be made of whatever is available.

Hence, on 7¼-in. gauge locomotives one finds advocates for placing the feet inboard or outboard. The preference is one of personal choice, though careful consideration may influence the matter. It is well to note that the late Mr. Henry Greenly commented in this journal (December 3rd, 1908) that it is more convenient to place the legs outside the tender, especially when it is necessary to do any firing or attend to the injector, etc. The reference includes drawings of a bogie driving and passenger truck.

To the observant, it soon becomes obvious that

one hand does most of the work, and so the pros and cons of R.H. and L.H. driving positions applicable to full-size operation hardly fit in with the requirements of a miniature locomotive. So, one departs from the conventional. The general feeling is, that it would be convenient to place certain controls as high as possible, and on an arc conforming roughly to the radius of the forearm. "Reach" or accessibility, rather than height, seems to be the determining factor; and, if the owner is right-handed, then the reversing arrangements should be on the right-hand side, and the tender brake on the left-hand side. Both are quite handy in such positions and do not foul firing operations, which are also carried out with the right hand.

A horizontal, or lower-quadrant regulator, should preferably be provided with an additional lever extending in an upward direction. The brake valve may be placed at the same level as this extension. Other controls may also be arranged to be more accessible to one hand, or in an ambi-dextrous style. Some may comment that, the result may look like "nothing on earth." Well! it is a question of ensure or endure. Ensure easy operation or endure a backache. It is worth thinking about, even though one's mind is apt to concentrate on the elements of sentient life within the locomotive.

Yours faithfully,

Christchurch. "H.J.H."

Club Announcements

South London Model Engineering Society

Over 7,340 passengers were carried on the South London Society's small-gauge railway during the Lambeth Civic Week celebrations.

Messrs. Pbilpott, Cook, Rowland, Bradford and Griffen's engines were in steam most of the time.

The London Society, the S.M.E.E., kindly sent their locomotive in charge of Messrs. Maxwell and Hart and did yeoman service; in fact, one afternoon, after three bours' running, Mr. Maxwell's happy smile began to fade when he found the crowds waiting for rides were still as big as ever.

The miniature railway will long be remembered by young, and old "down Lambeth Way."

Hon. Secretary: W. R. Cook, 103, Engleheart Road, Catford, S.E.6.

The Faversham and District Model and Experimental Engineering Society

At the last meeting of the above society a very interesting talk was given by Mr. W. Osmond on attachments and accessories to his 3½ in. "Zyto" lathe.

On September 9th a mixed party of members and friends of tbe society paid a visit to the Boxley pumping station of the Maidstone Water Company. This proved to be a most successful and informative outing and our thanks are due to the company's engineer Mr. F. C. Hill, for making it so.

The following arrangements have been made for future meetings:—

October 21st. Ordinary meeting at headquarters; talk by Mr. H. Herbert on "Small Locomotive Construction."

November 10th. Ordinary meeting at headquarters. Demonstration by Mr. T. Grove on oxy-acetylene cutting, welding, brazing, etc.

December 11th. Ordinary meeting at headquarters. Talk by Mr. Giles on "Road Locomotives."

All the above meetings are at 7.30 p.m.

Hon. Secretary: R. W. Partis, 14, Edith Road, Faversham, Kent.

The Society of Model and Experimental Engineers

At the stationary engine meeting to be held on October 30th, at St. Peter's School, Windmill Street, W.1, members are requested to bring along any experimental gear or other working apparatus for demonstration purposes. Internal combustion engines and steam plant will be welcome.

Hon. Secretary: E. L. Ashton, 20, Pollards Hill West, Norbury, S.W.16.

City of Leeds Society of Model and Experimental Engineers

The above society has now finished its busy summer season witb a track meeting on September 11th. Six locomotives were under steam during the day, Mr. Laycock's "Royal Scot" being in running order for over five hours. Mr. Cook, our president, had bad luck when tbe water gauge glass on his model broke just after he was starting on his first trip of tbe day. In Mr. Colbran's four-cylinder 2½-in. gauge hybrid, we saw an engine witb a terrific acceleration.

An exhibition was held in August at Messrs. Lewis's Ltd., wben many models were on show, tbe electric "O" gauge track and stationary engines running under compressed air were a great attraction.

Meetings are under way again now, these being held at the Salem Chapel on the first and third Thursdays in the month, when visitors or anyone interested will be welcome.

Hon. Secretary: R. G. Colbran, 9, Church Wood Avenue, Headingley, Leeds, 6. 'Phone No. 55333.

The Coventry Model Engineering Society

October 21st-23rd. Annual exhibition at Trinity Hall, Ford Street.

October 29th. Lantern lecture at the Gas Showrooms entitled "Scale Locomotive Modelling," by Mr. J. N. Maskelyne, Technical Editor of The Model Engineer.

November 5th. Exhibition report at B.T.H. Social Club.

November 12th. Lecture at the Gas Showrooms entitled "Locomotive Construction in Gauges 'O' and 'OO'," by Mr. P. G. Rose, of Birmingham.

November 19th. At B.T.H. Social Club. "Internal Combustion" Group Discussion.

November 26th. At B.T.H. Social Club. Projection Night for members' fims.

From the above it will be seen that we have a whole series of lectures arranged for the next few months, and the speakers are all well-known figures in the model engineering world.

Hon. Secretary: H. R. Dunkley, 94, Belgrave Road Coventry. Telephone: Walsgrave-on-Sowe 306.

The Bolton and District Society of Model Engineers

As a result of the opening of our locomotive and car tracks in July and our exhibition in August, there has been an influx of new members. We are looking forward to a good winter season. Details of our programme to be published later.

We give a hearty invitation to all locomotive and car enthusiasts, whether members of clubs or lone hands, to come to Bolton with their locomotives or cars and to make use of our tracks at Leverhulme Park. We shall be at home to visitors (without notice) on the third Saturday and following day in each month, commencing October 16th-17th. Other times must be by arrangement or by invitation. Our friends will be very welcome and we hope they will take advantage of this invitation.

Hon. Secretary: C. E. Picken, 139, Smithills Dean Road, Bolton. Tel.: Bolton 363.

NOTICES

The Editor invites correspondence and original contributions on all small power engineering and electrical subjects. **All such correspondence should be addressed to the Editor (and not to individuals)** at 23, Great Queen Street, London, W.C.2. Matter intended for publication should be clearly written, and should invariably bear the sender's name and address.

Readers desiring to see the Editor personally can only do so by making an appointment in advance.

All correspondence relating to sales of the paper and books to be addressed to The Sales Manager, Percival Marsball & Co. Ltd., 23, Great Queen Street, London, W.C.2.

Correspondence relating to display advertisements to be addressed to The Advertisement Manager, "The Model Engineer," 23, Great Queen Street, London, W.C.2.